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x-ray videocorder model PVX-100

SERVICE MANUAL

FOREWORD

This manual, although specified for the PVX-100 Videocorder, contains information identical to the PV-100 manual.

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SERVICE MANUAL

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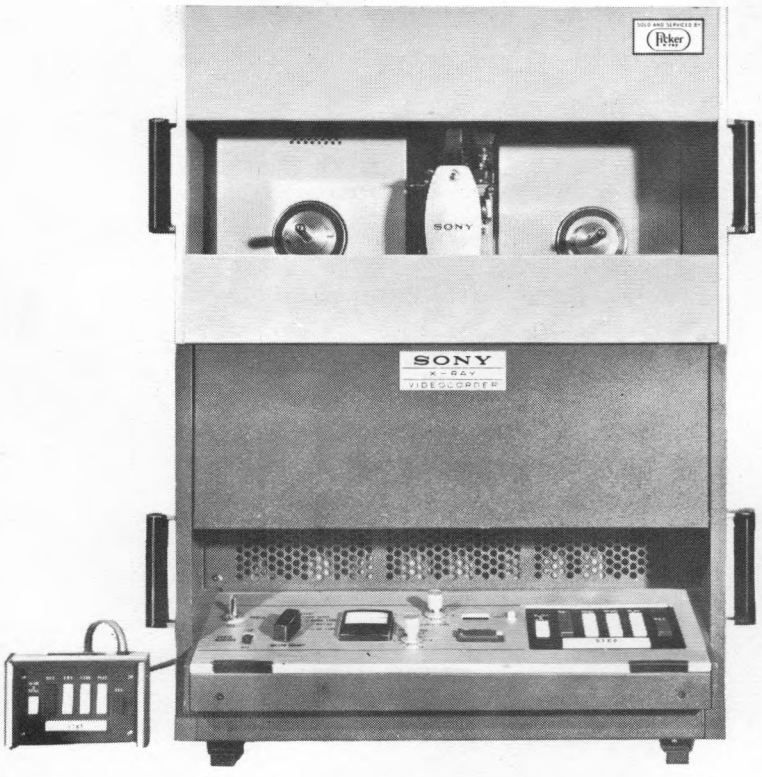


Figure 1-1. SONY X-Ray Videocorder Model PVX-100

chapter I / INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

The Sony PVX Videocorder is designed for simplicity of operation and ease in maintenance. The operation of the Videocorder is described in the Operating Instructions. The purpose of this manual is to acquaint the operating personnel with the general theory of the recording of video signals on magnetic tape, provide them with specific technical and mechanical descriptions of the Videocorder, and provide them with complete electrical and mechanical set-up and maintenance procedures.

1-2. EQUIPMENT SUPPLIED

The following equipment is supplied with the PV100 Videocorder:

Packing case
AC line cord
Reel of tape, 1800 ft.
Take-up reel
Chamois for cleaning
Remote Control Unit, PVR-100
Leather accessory case

1-3. ACCESSORIES AVAILABLE

The following accessories may be ordered for the Videocorder:

Mechanical Maintenance Tool Kit
19" RF Jeep Monitor Model PVM-119
5" RF Jeep Monitor Model PVJ-303R
Complete line of conventional video monitors 5" to 27".
Complete line of TV cameras, microphones and audio units.
Rack Mounting Hardware Kit

1-4. CONSTRUCTION

The Videocorder is housed in a compact, rigid metal cabinet, having panels which are completely removable for servicing. Two folding carrying handles are provided on each side of the cabinet to facilitate handling. The outside of the cabinet is finished in dark gray and light gray. On the front of the unit is the Control Panel and the Tape Transport and Head Drum mechanism. Access to the tape reels is gained by raising the tape transport cover and access to the head drum by pulling down the head drum cover. This cover is electrically interlocked and must be closed before the equipment can be operated. By removing both side panels and adapting L-shaped metal fittings to the sides of the Videocorder, the unit can be easily mounted in a standard 19-inch equipment cabinet.

At the rear of the unit, provision is made for connecting all input and output cables and for selecting the input signal source.

The cabinet housing of the Videocorder is finished in two colors: dark and light gray.

On the front of the Videocorder are the various mechanical and electrical control panels: Tape transport panel with its transparent dust cover, and operating control panel.

The rear of the machine contains the connector panel on which all input and output cabling is terminated.

1-5. SPACE REQUIREMENTS

The space requirements for the table-top installation of a Videocorder with a Sony Video Monitor, PVM-119 are shown in Fig. 1-2.

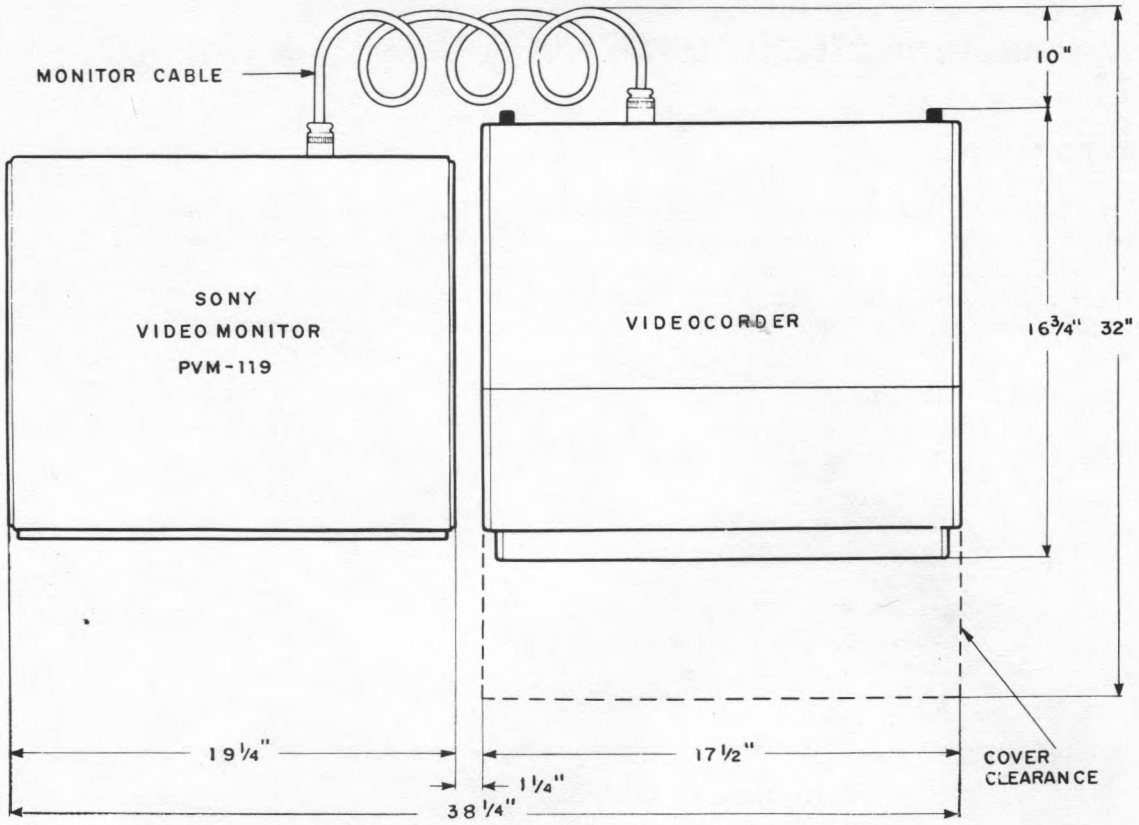


Figure 1-2. Space Requirements for Videocorder with SONY Video Monitor Model PVM-119

1-6. SPECIFICATIONS

The principal specifications of the Videocorder are as follows:

MECHANICAL

Dimensions: 17-1/2" (W) x 25" (H) x 16-3/4" (D)
Weight: 145 pounds
Complete modular construction
Completely enclosed transport mechanism

PERFORMANCE

Recording medium: 2" wide tape, low-friction, Sony type V-21L

Tape speed:
- Record: 5-3/4 ips approx.
- Playback - Normal Mode: 5-3/4 ips approx.
- Playback - Slow Motion: 0.1 ips approx.
- Playback - Stopped Motion: Zero ips

Recording time: 63 minutes on 7 inch reel, 1800 feet tape.

Rewind time: Approximately 4 minutes.

Slow motion: 1/60 normal rate.

Still picture: Freeze Frame for up to 5 min.

Lock-in time: 4 seconds (nominal) starting time, 0.3 seconds still, 3 seconds slow.

Index counter: positive position indicator.

Photocell: provides automatic stop without unthreading the tape.

Tape Life: average of 1000 passes of tape, normal operation.

Video Head Life: guaranteed 500 hours with normal routine maintenance.

1-6. SPECIFICATIONS (Continued)

Signal to Noise ratio:
Video: more than 43 db
Audio: more than 40 db

Resolution: Horizontal 250 lines.

Servo Systems: Head motor servoed

Erase Factor: Better than 60 db.

Audio Response:
+1 db 100 cycles to 5000 cycles
+1 -4 db 50 cycles to 100 cycles
+1 -4 db 5000 cycles to 10,000 cycles

Wow and Flutter: 0.5% rms

Temperature operating range: 0° C. to 40° C.

Heads:
Video record/playback
Vertical sync. record/playback
Audio record/playback
Control track
Main Erase
Audio Erase

Erasing:
Full video signal, sync. audio and control signal erasure; separate erase head for audio.

ELECTRICAL

Input power: 117 volts ±5%, 60 cps

Power consumption: 350 watts

Input Signals:
Video: Composite with 60 cps field frequency, random 2 to 1 industrial or EIA sync. at a level of more than 0.5 volts peak to peak, sync. negative. (All scan line systems.) Termination: 75 ohms unbalanced.

Audio: Microphone (600 ohms) -70 dbm and Line (10,000 ohm) +4 dbm, balanced. Single or dual audio, as required. (Dual audio is optional extra.)

Output Signals:
Video: 0 - 1.4 V pp. 75 ohms, unbalanced, sync. negative.
Audio: 600 ohms, balanced +4 dbm.

1-7. SONY WARRANTY FOR MATERIAL AND WORKMANSHIP

All Videocorder parts for a period of one (1) year, except video and sync. heads which are guaranteed for 500 hours, or one year whichever shall occur first.

chapter II / OPERATING INSTRUCTIONS

2-1. GENERAL

It is recommended that this chapter be thoroughly read before the Videocorder is operated for the first time and that the following precautions are complied with.

1) Unpack the Videocorder, and insure that all necessary accessories are included with the unit. Place unit on rigid table, or in the equipment cabinet.

2) Avoid locating the equipment near strong magnetic fields, or near sources of noise-generating equipment such as motors, generators or voltage regulators.

3) Avoid operating the Videocorder in dusty areas. Dust or sand particles can cause adverse effects on the tape transport mechanism of the unit.

4) In handling, avoid any unnecessary shock or impact to the tape transport mechanism.

2-2. SYSTEM INSTALLATION

The Videocorder does not require any special installation arrangements and is shipped tested and ready for use.

The unit is extremely flexible in its application, and since it is impractical to cover all of the variety of installations, only a few of the more commonly used setups are outlined. By studying these arrangements it will be easy to use them as a guide in setting up equipment to fit varying installation requirements.

NOTE: Before making any connections, be certain that the Videocorder POWER ON-OFF switch is set to OFF. Press the STOP Button and set the AUDIO LEVEL and VIDEO LEVEL knobs fully counterclockwise to "0". Also be sure that the controls of the associated equipment are set in such a way that no difficulties will occur when the units are connected.

2-2.1 Videocorder with SONY Monitor.

Figure 2-1 shows the Videocorder connected to the SONY Video Monitor Model PVM-119. Connections for the Sony Micro Video Monitor Model PVJ-303R are the same. With this installation, the video and audio signals detected by the monitor (either over the air or through lines) can be recorded by the Videocorder.

The monitor is used to monitor the incoming signal during recording and for playing back the recorded signal.

Make the Videocorder connections for the installation of figure 2-1 as follows:

1. Set the INPUT SELECT AIR-LINE Switch on the Rear Connector Panel to the AIR position.

2. Take off the dust cap of the Videocorder MONITOR Receptacle by unscrewing it in a counterclockwise direction.

3. Connect the plug of the monitor cable provided with the SONY monitor into the receptacle (fig. 2-2). Turn the lock cap of the plug in a clockwise direction to lock the plug in the receptacle.

4. Connect the female plug of the Videocorder power cord into the AC IN Receptacle on the Rear Connector Panel (fig. 2-3). Lock the plug in the receptacle by twisting it in a clockwise direction after inserting.

5. Plug the Videocorder and monitor power cords into the AC power source.

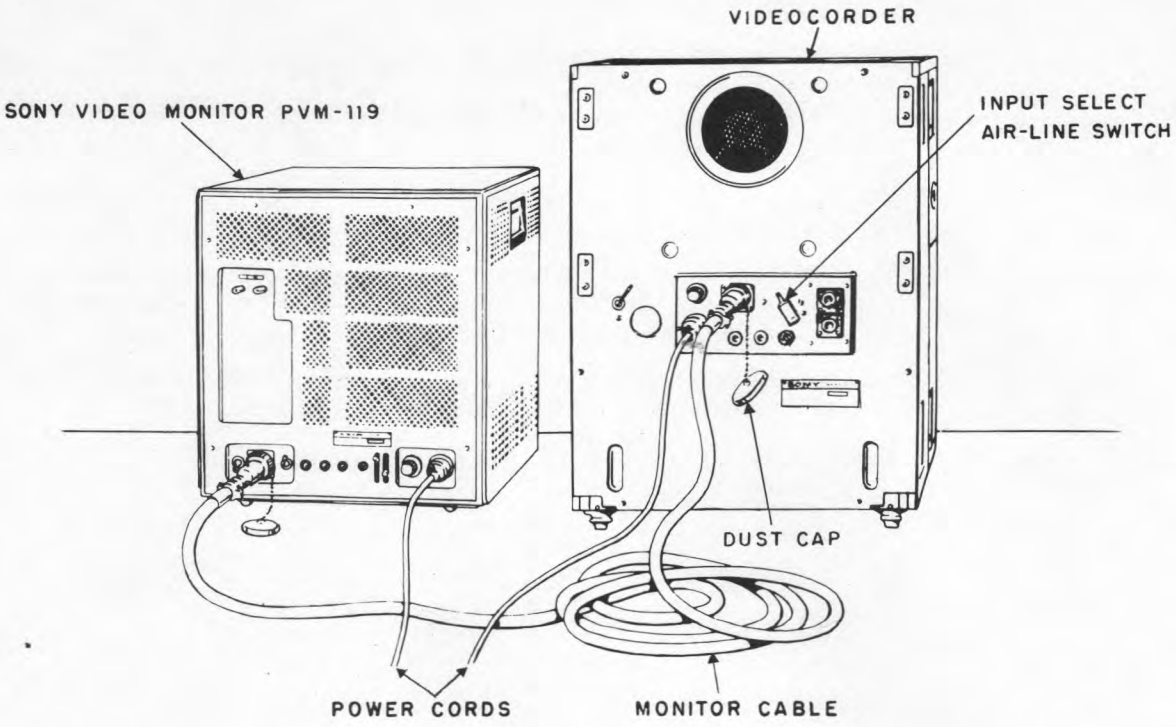


Figure 2-1. Connections for the Videocorder with SONY Video Monitor Model PVM-119

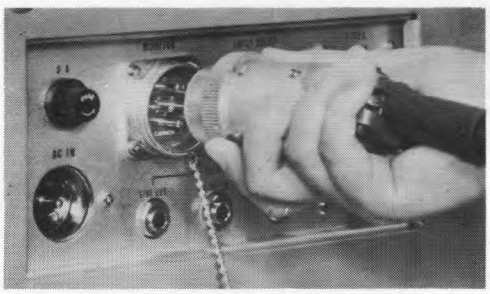


Fig. 2-2. Connecting Monitor Plug to Videocorder

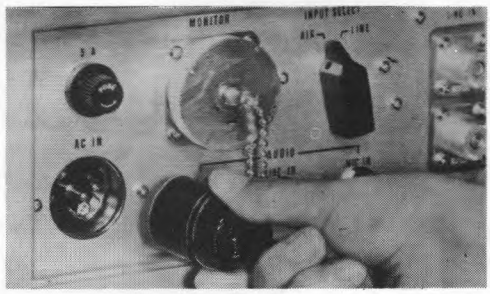


Figure 2-3. Connecting Power Cord Plug to Videocorder

2-2.2 Videocorder with Conventional Monitors.

Figure 2-4 shows the Videocorder connected to conventional video and audio monitors. With this installation, the video and audio signals being recorded by the Videocorder can be monitored and the monitors can be used for playing back. The video and audio input signals to the Videocorder can be taken from any desired source.

Make the connections for the installation of figure 2-4 as follows:

1. Set the INPUT SELECT AIR-LINE Switch on the Rear Connector Panel to the LINE position.
2. Connect a 75-ohm impedance coaxial cable from the video input of the monitor to the VIDEO LINE OUT Socket of the Videocorder (fig. 2-5). Be sure the locking ring of the cable plug is screwed in place.

   NOTE: The level of the Videocorder output video signal is 1.4 volts, peak to peak with a 75-ohm unbalanced impedance.
3. Connect a shielded cable from the audio input of the monitor to the AUDIO LINE OUT Jack of the Videocorder (figure 2-6).

2-2.2 Videocorder with Conventional Monitors (Continued)

NOTE: The level of the Videocorder output audio signal is +4 dbm with a 600 ohm balanced impedance.

4. Connect a coaxial cable from the video signal source to the Videocorder VIDEO LINE IN Socket (fig. 2-7). Be sure the locking ring of the cable plug is screwed firmly in place.
5. Connect a shielded cable from the audio signal source to the Videocorder. For a high-level signal (+4 db), plug into the AUDIO LINE IN Jack of the Videocorder (fig. 2-8). For a low-level signal (-70 db), plug into the AUDIO MIC IN Jack.
6. Connect the female plug of the Videocorder power cord into the AC IN Receptacle (fig. 2-3). Lock the plug in the receptacle by twisting it in a clockwise direction after inserting.
7. Plug the Videocorder and the monitor power cords into the AC power source.

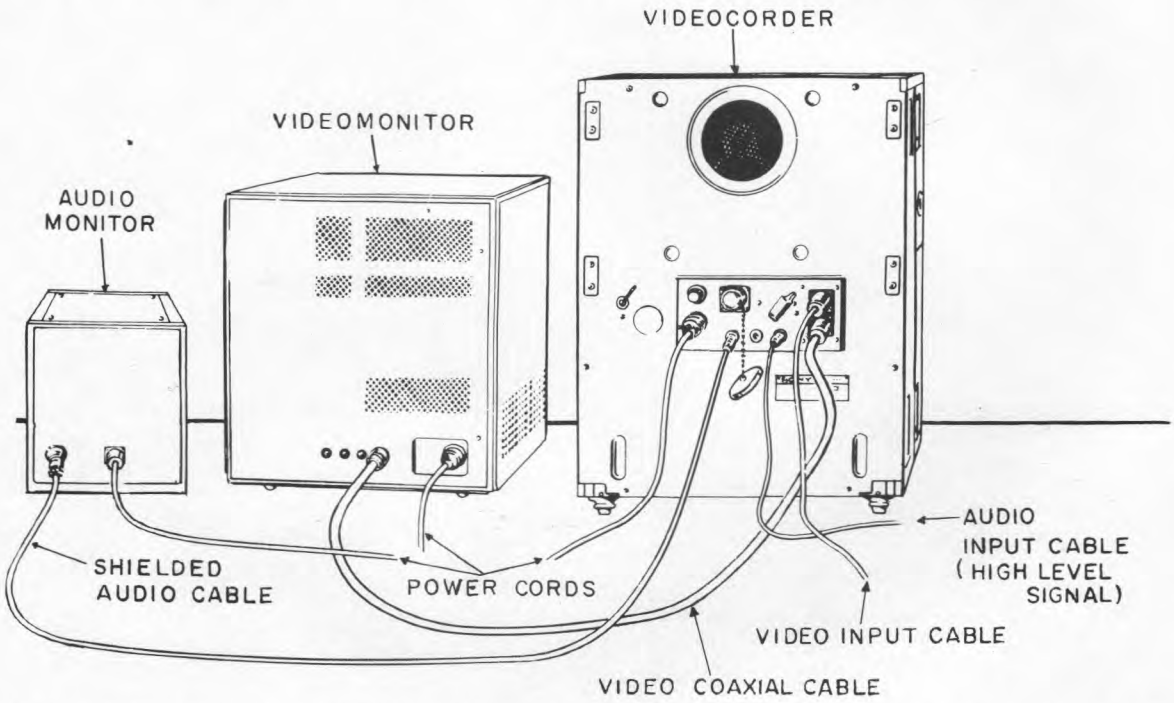


Figure 2-4. Connections for the Videocorder with Conventional Video and Audio Monitors

2-2.3 Videocorder with SONY Monitor, Camera, and Microphone.

Figure 2-9 shows the Videocorder connected to a SONY Video Monitor Model PVM-119 with the input signals being provided by a camera and microphone. As the input signals are recorded, they are monitored on the PVM-119. This monitor can then be used for later viewing of the recorded material.

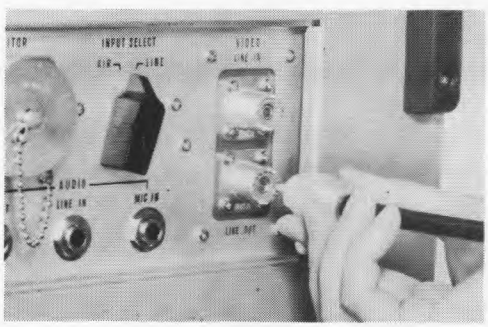


Figure 2-5. Connecting Video Monitor Coaxial Cable to Videocorder

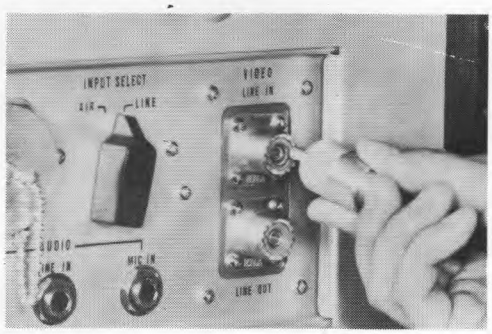


Figure 2-6. Connecting Video Signal Source Coaxial Cable to Videocorder

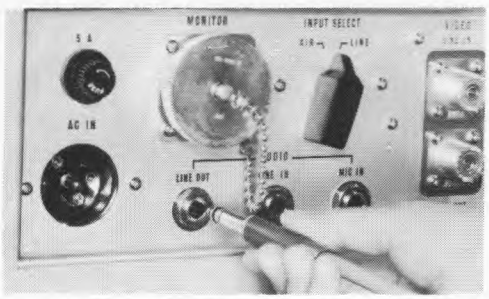


Figure 2-7. Connecting Audio Monitor Shielded Cable to Videocorder

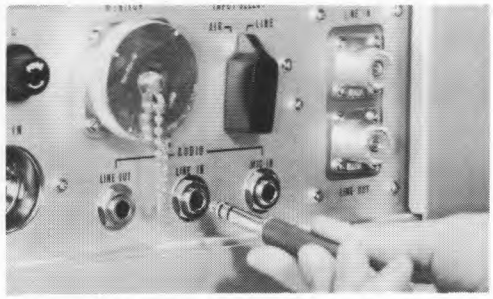


Figure 2-8. Connecting Audio Signal Source Shielded Cable to Videocorder

2-2.3 Videocorder with SONY Monitor, Camera, and Microphone (Continued)

The SONY Monitor is connected to the Videocorder in the same way as explained in paragraph 2-2.1, except that the INPUT SELECT AIR-LINE Switch is set to LINE. The coaxial cables for the camera and microphone inputs are connected to the VIDEO LINE IN and AUDIO MIC IN Jacks of the videocorder as explained in steps 3 and 4 of paragraph 2-2.2.

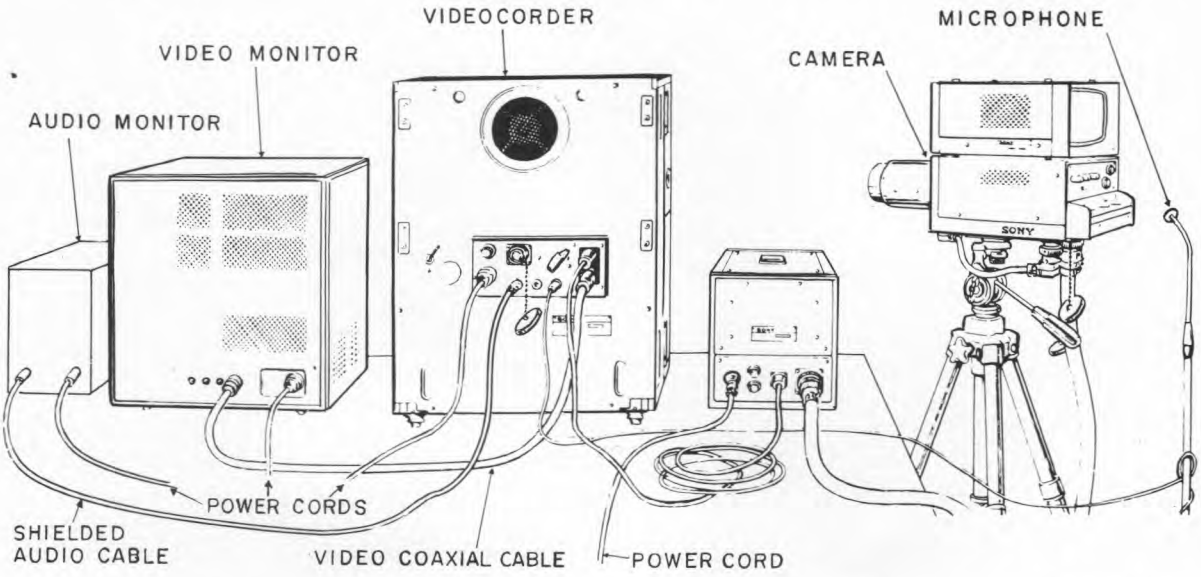


Figure 2-9. Connections for the Videocorder and SONY Monitor with Camera and Microphone

2-2.4 Videocorder Setup for Remote Control

In any equipment setup, remote control of the Videocorder can be obtained through the use of a Remote Control Unit Model PVR-100. To connect the Remote Control Unit to the Videocorder, open the cover of the Remote Control Receptacle by pushing the adjacent lever counterclockwise and insert the plug of the remote control cable into the receptacle (fig. 2-10).

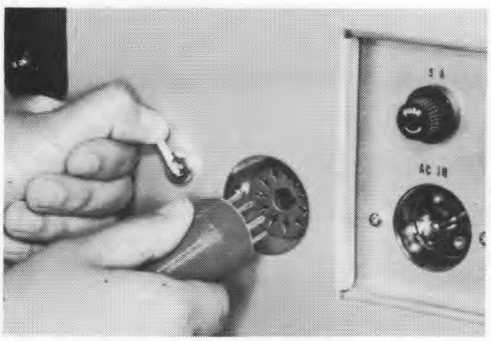


Figure 2-10. Connecting Remote Control Plug to Videocorder

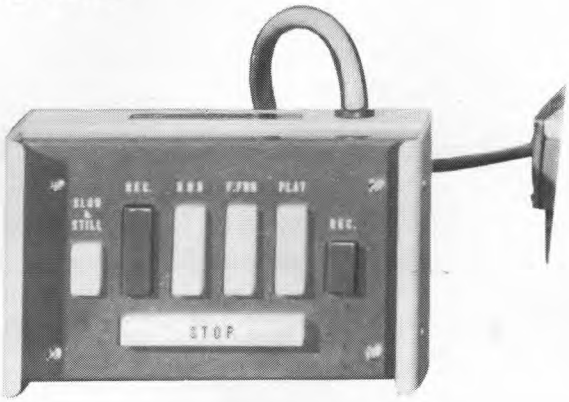


Figure 2-11. Remote Control Unit

2-2.5 Videocorder Setup for Tape Duplication.

Figure 2-12 shows the Videocorder setup for duplicating tapes. The tape to be duplicated is played back on one Videocorder while the other Videocorder records the signals from the playback unit. Two SONY Monitors are used; one to observe the playback signals and the other to observe the recorded signals.

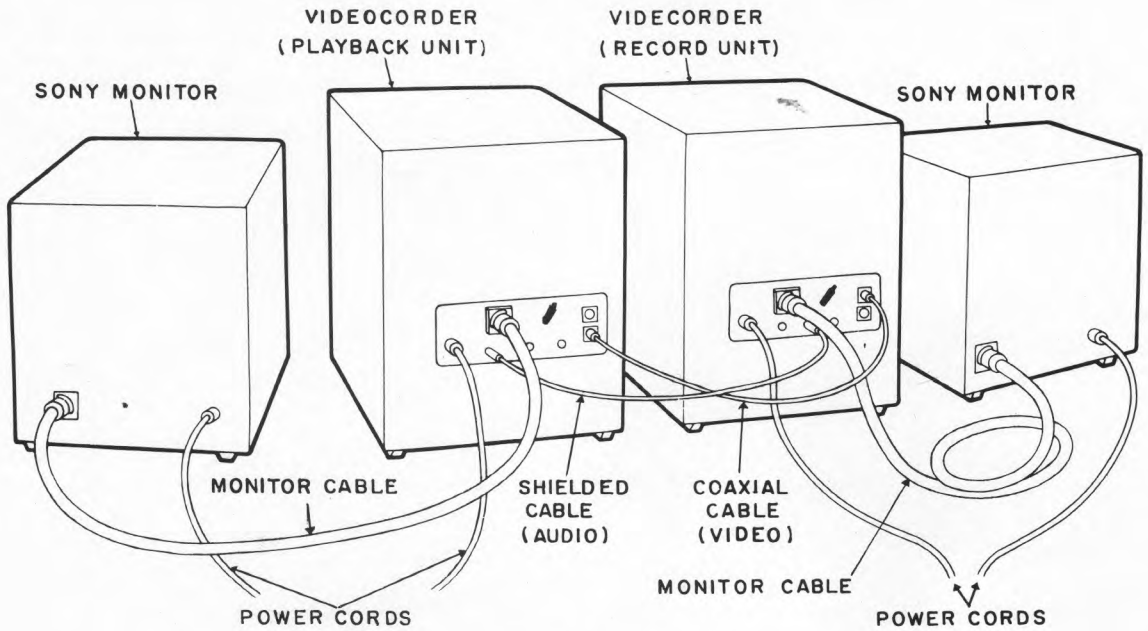


Figure 2-12. Videocorder Setup for Tape Duplication

Each monitor is connected to its associated Videocorder, and the units are connected to the power source, as explained in paragraph 2-2.1. Make the following additional connections between the Videocorders:

1. On the record unit, set the INPUT SELECT AIR-LINE Switch to the LINE position.

2. Connect a 75-ohm impedance coaxial cable from the VIDEO LINE OUT Socket of the playback unit to the VIDEO LINE IN Socket of the record unit. Be sure the lockings rings of the cable plugs are screwed firmly in place.

3. Connect a shielded cable from the AUDIO LINE OUT Jack of the playback unit to the AUDIO LINE IN Jack of the record unit.

2-3. SYSTEM OPERATION

For a detailed description of the Videocorder operating controls and functions please refer to the "Operating Instructions" manual, chapter 2.

We strongly recommend that a person have a thorough understanding of the operating instructions before attempting to perform electrical or mechanical adjustments on the Videocorder.

chapter III / THEORY OF OPERATION

3-1. MAGNETIC TAPE THEORY

When a magnetic material is placed in a magnetic field, the magnetic material is oriented in the direction of this field in proportion to the strength of the field and thereby becomes magnetized.

In the record mode, with a varying input signal feeding the magnetic head winding, a proportional magnetic field is created in that area immediately in contact with the magnetic tape. This magnetic field caused by the current flow is concentrated within the gap area of the head, and the associated leakage flux magnetizes the tape proportionally to the input signal.

As the tape is pulled through this head gap a magnetic pattern is imposed onto the tape as shown in Fig. 3-1.

With the tape machine in Playback mode the recorded tape passes through the gap of the playback head, thereby inducing a voltage in the head coil winding as shown in Fig. 3-2. The value of this induced voltage is directly proportional to the number of turns of this coil, permeability of the magnetic material, and the rate of change of the magnetic flux. Thus, as shown in Fig. 3-3, with constant tape speed the induced voltage is proportional to the frequency of the recorded signal.

Actual practical experience has demonstrated that the accumulative losses due to tape thickness, head gap loss, etc., produce a fall-off in the high frequency spectrum and the actual induced voltage curve versus signal frequency curve follow the solid lines, as shown in Fig. 3-3, rather than the dotted ideal 6 db/octave curve.

In the recording of television signals on magnetic tape this high frequency limitation must be overcome.

3-2. DESIGN PROBLEMS IN THE RECORDING OF TELEVISION SIGNALS

Essentially, the process of recording of a video signal on magnetic tape is very similar to the processes associated with the recording of an audio signal.

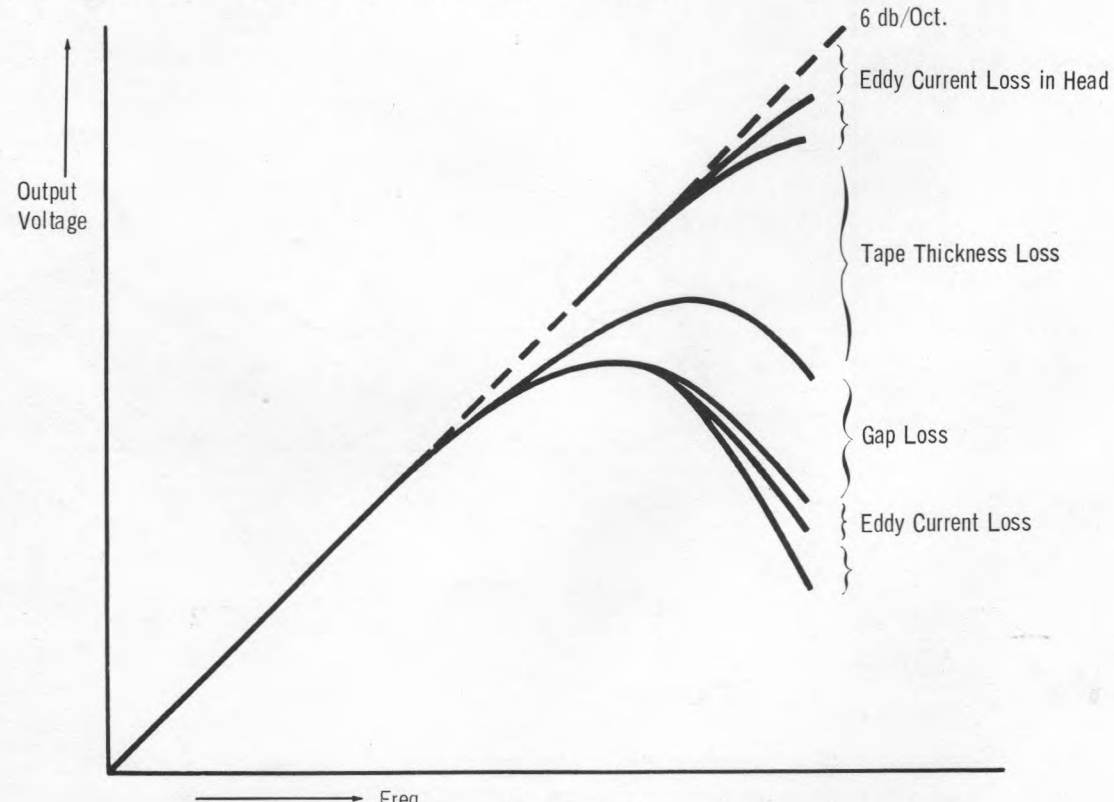


Figure 3-3.

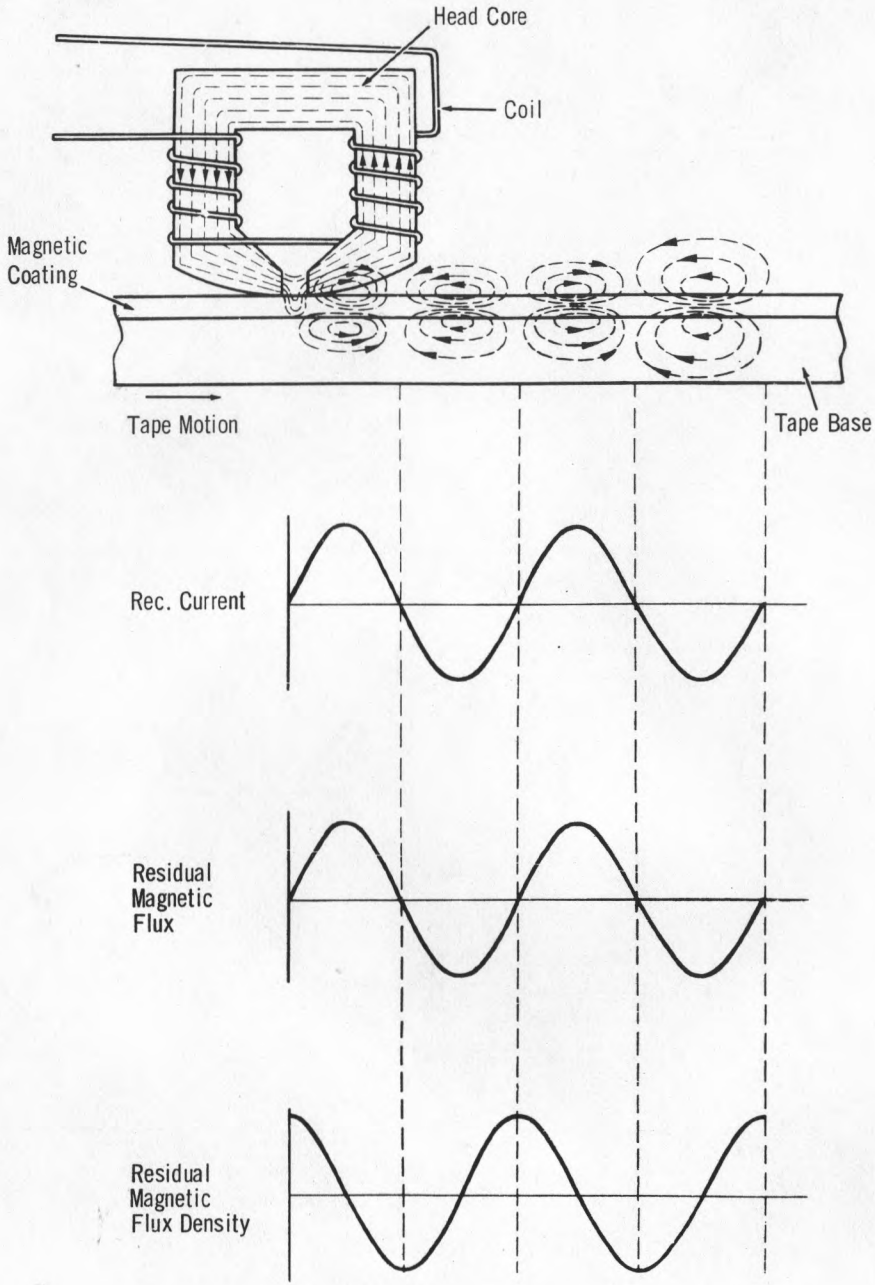


Figure 3-1. Magnetic Pattern During Record Mode

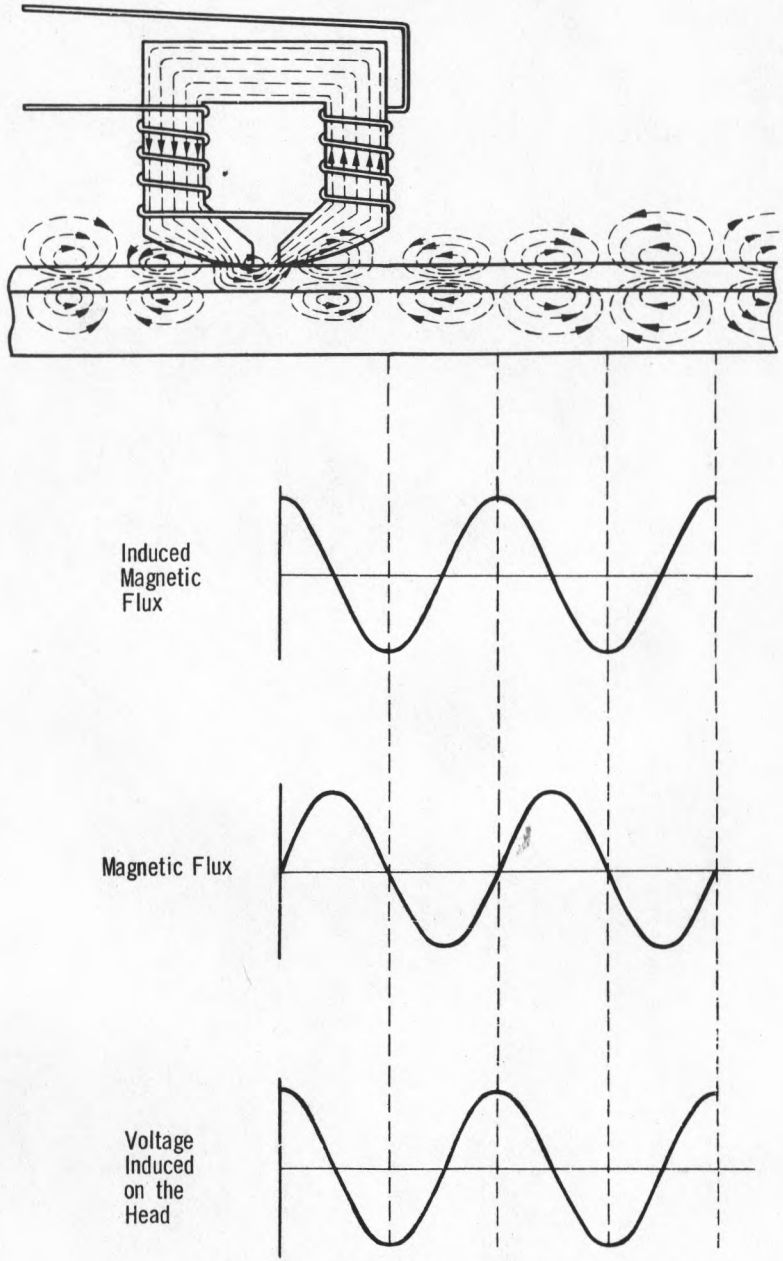


Figure 3-2. Magnetic Pattern During Playback Mode

3-2. DESIGN PROBLEMS IN THE RECORDING OF TELEVISION SIGNALS (Continued)

The video signal, however, has a frequency range of 30 cycles to approximately 4 mcs, a spread of more than 18 octaves. We have already discussed some of the inherent system limitations to the upper range of frequencies. Additionally, a television recording system has also to overcome the high frequency limitations imposed by the magnetic tape itself, which can only handle a range of approximately 10 octaves.

The characteristics in the low frequency range are equally important and these are determined by the frequency response curve of the playback head and the required signal-to-noise ratio.

It should now be apparent that the recording of television signals on magnetic tape requires some different approaches than those we are familiar with in the audio recording field. Some of these are:

1. Increase in the tape-to-head speed to increase bandwidth.
2. Making the head gap as narrow as possible in order to obtain as wide a bandwidth as is possible.
3. Provision for a special signal scanning system on the tape.
4. Provision for a special signal transmission system.
5. Design of a suitable tape transport mechanism.

The ensuing paragraphs will explain how these problems have been overcome in the design of the SONY Videocorder.

3-3. RECORDING TECHNIQUE OF VIDEOCORDER

3-3.1 General

The SONY Videocorder is a magnetic tape recording and reproducing system enabling the user to record and playback any composite video signal and associated audio programming. This information can be stored for an indefinite period, or immediately viewed.

The SONY Videocorder utilizes the unique "slant track" scanning system with an FM signal transmission system, in conjunction with the especially developed high quality magnetic tape, SONY V21-L and associated magnetic heads.

Utilizing 2" wide magnetic tape, the Videocorder is capable of recording more than 60 minutes of programming on a 1800 foot, 7-inch reel of tape, at a speed of 5.75 inches per second.

3-3.2 Recording Track Scanning System, Video Signal

One of the basic system requirements is to obtain a maximum signal density of the signal to be recorded with a minimum head gap and recording track width. Other factors that enter into the selection of various track scanning methods are signal-to-noise requirements, resolution, signal level deviation, and jitter content in reproduced picture.

The four scanning systems to be discussed are shown in Fig. 3-4.

1. System A or B (single or multi-track system)

In order to record a video signal while utilizing the scan methods depicted in A and B, it would be necessary to increase the head-to-tape speed and to narrow the head gap as much as possible. In these systems a 2 micron head gap with a head-to-tape speed of approximately 18 feet/sec. would be required for a recordable frequency range of approximately 2.5 mcs. However, these systems result in great level deviation, difficulty in tracking because tape speed is relatively high, and a tape utilization efficiency of only a few percent.

2. System C (Vertical Scanning System)

This scanning system overcomes most of the shortcomings of the above mentioned systems and is utilized in the expensive professional recorders. In contrast, this system results in the utilization of approximately two-thirds of the tape area available for recording.

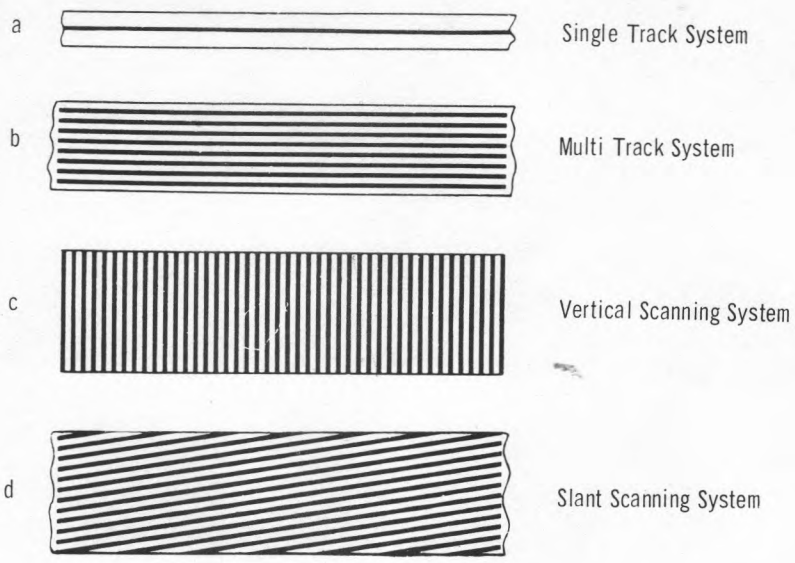


Figure 3-4.

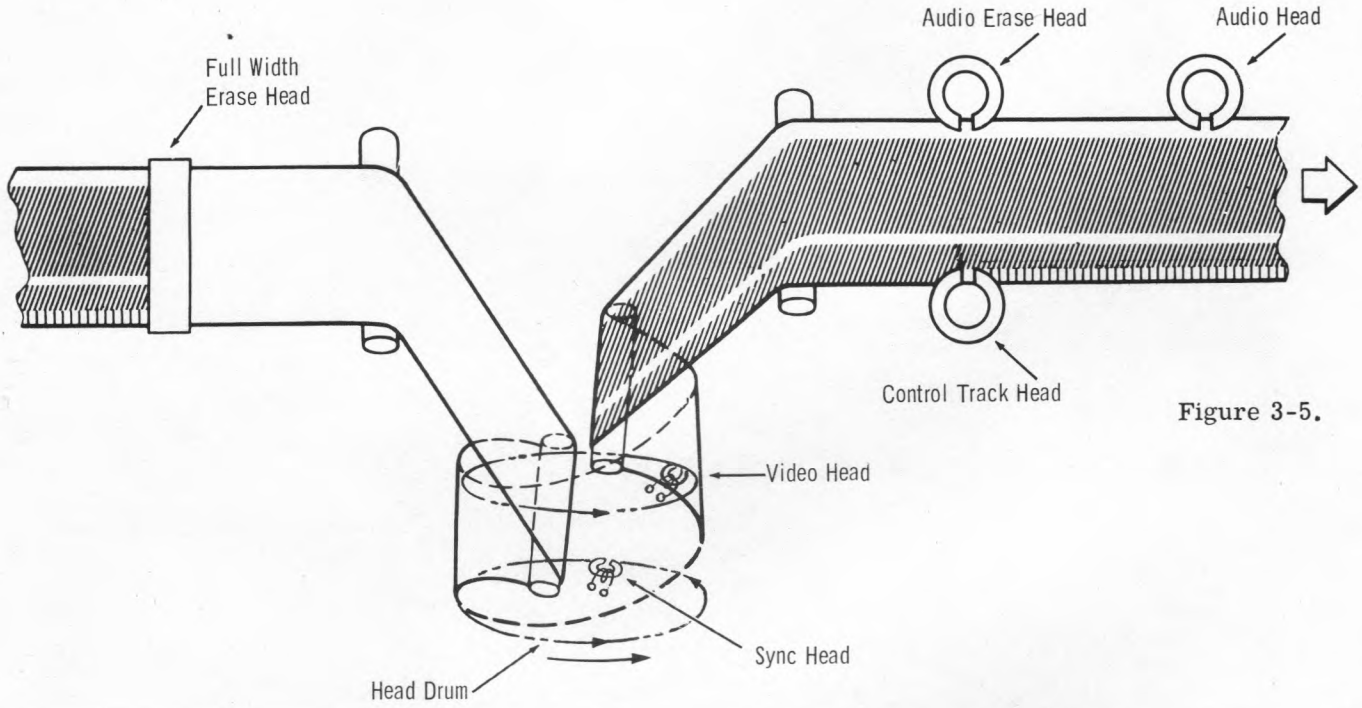


Figure 3-5.

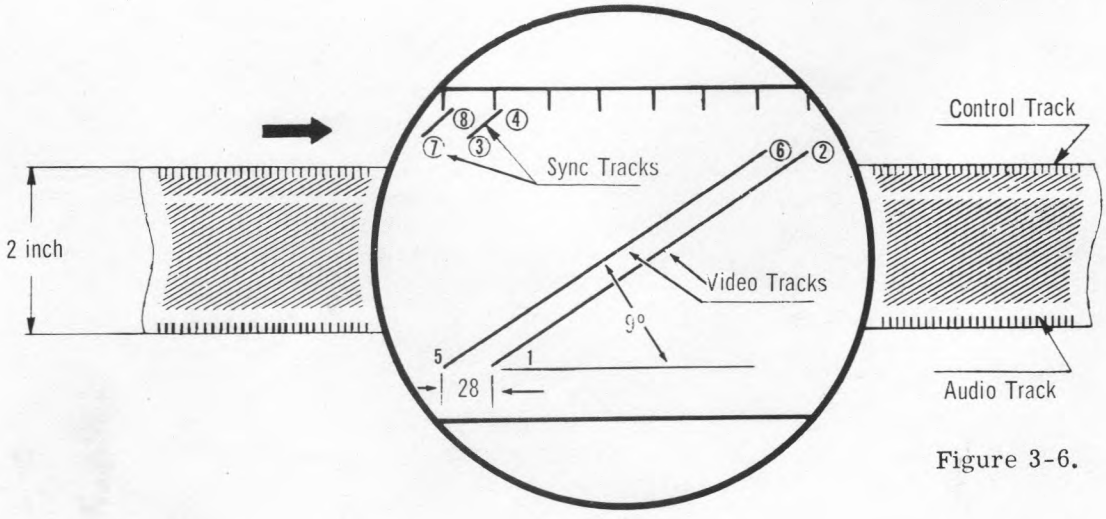


Figure 3-6.

3-3.2 Recording Track Scanning System, Video Signal (Continued)

On the other hand, this system has the inherent shortcoming that the mechanical and electronic design must of necessity be complicated due to the fact that one field of a composite video signal is recorded on sixteen separate tracks by four individual heads.

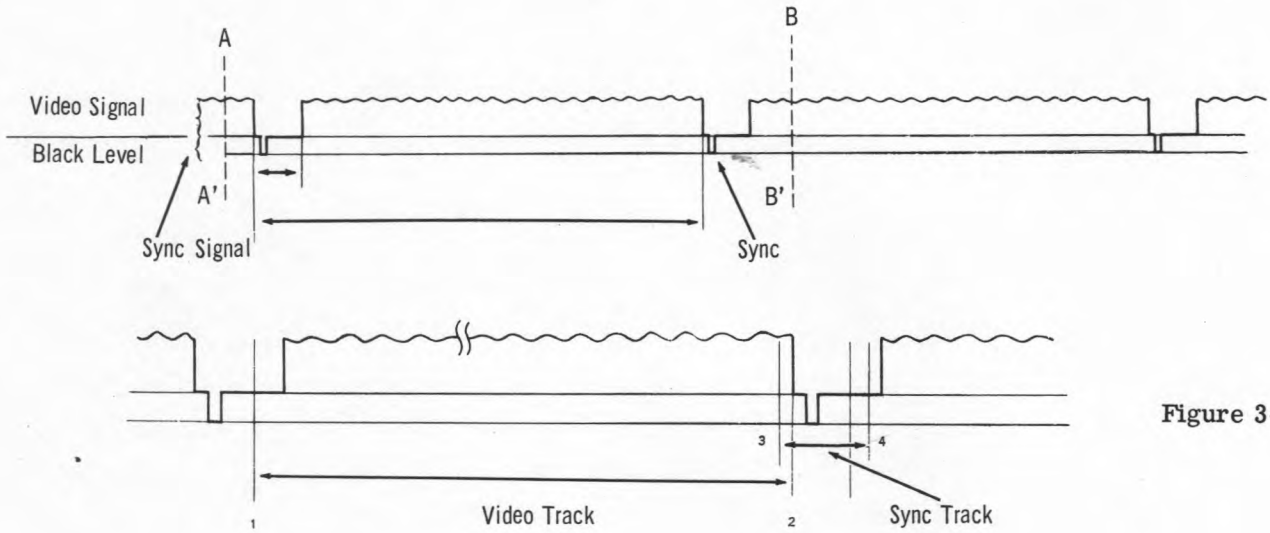


Figure 3-7.

3. System D (Slant Scanning System)

In this scan system one video head scans the tape diagonally and with the proper slant-track angle, one field of composite video is recorded on one track. This method of scanning results in a tape efficiency equal to that realized with the vertical scan system.

Furthermore, the slant-track scan system results in a distortion-free picture (no banding, scalloping, venetian blind effect, etc., so familiar in vertical scan systems), mechanical positioning of the video head is less critical, and a complicated head-motor servo system is not required.

The SONY Videocorder PV-100 is designed for ease of operation similar to an audio tape recorder, small size, and minimum weight. To achieve these design criteria the unique SONY slant-scanning system was developed.

3-3.3 Additional Recording Functions

In addition to the recording of the aforementioned video signal track, the Videocorder is designed to record other signal tracks necessary for the control and playback of complete television programming.

The Videocorder has four recording/reproducing heads for the processing of the video, sync., control track and audio signals & additionally, a full-width erase head, and an audio track erase head are provided.

The relative position of each head is shown in Fig. 3-5 and the position of each signal track is shown in Fig. 3-6.

The video and sync. heads are located on a rotating head drum around which the magnetic tape is guided at a slant angle.

A composite video signal is recorded onto the tape by the utilization of both of these heads. The video head recording the video signal while the sync. head records the blanking portion of the vertical sync. block.

Figs. 3-6 & 3-7 show the position of each track as observed on the coated surface of the tape and

3-3.3 Additional Recording Functions (Continued)

while viewing one TV line signal. With the tape and head drum rotating at their rated speeds, the video head records a video signal on track 1-2 during one rotation of the head drum as the sync. head records the sync. signal on track 3-4.

In the Record mode, as the tape is pulled through the full-width erase head all previously recorded tracks are erased. The tape then passes around the rotating head drum where the video and sync tracks are recorded as the tape passes over the video and sync heads. The tape then goes through the stationary head assembly for the recording of the control and audio tracks.

An audio erase head is also provided on the Stationary Head Assembly to enable the erasure of the audio track only. Activation of the AUDIO DUB Switch energizes the audio erase head.

1) Recording of a Composite Video Signal

The video signal is fed into the control panel of the unit from the input connectors on the rear panel. The signal input level is routed through the Video Level control on this panel, and the signal is then fed to the input of the Modulator. In this circuit, the video signal is amplified, clamped, and then FM modulates the 3 mc carrier.

Within the modulator, the amplified signal is also routed to a vertical sync sampling and separator circuit. Its vertical sync output is then fed to Servo system.

The FM signal output of the modulator is fed into a linear two-channel record amplifier where the signal is again amplified. It is then fed to the video and sync heads through the Roto-Coil assembly for recording on the magnetic tape.

The FM signal from the modulator is also fed to the demodulator where the signal is demodulated, thus providing complete monitoring of the recording signal.

2) Recording of the Audio Signal

The audio signal from the Microphone Input is amplified in the Audio Record Pre-amplifier and then routed to the control panel for level adjustment. An audio signal fed into the LINE INPUT jack is routed directly to the control panel.

The audio is then fed to the Record amplifier for amplification and equalization. This signal is also mixed with a high-frequency bias signal derived from the audio erase oscillator and the combined audio signal is then fed to the audio head.

The audio signal appearing at the control panel Audio Level control is also routed to the line amplifier for an external monitoring feed.

During the subsequent drum rotation video track 5-6 and sync. track 7-8 are recorded. The tape is then pulled through to the Stationary Head Assembly where the control track signal of a 60 cycle pulse is recorded on the upper edge of the tape. The audio signal is then recorded on the lower edge of the tape.

3-3.4 Modulation of the Composite Video Signal

It was earlier stated that the reproducing head output of a magnetic tape recorder has a characteristic of 6 db/octave versus the decreasing frequencies. If we were to attempt the direct recording of a wide band signal, such as a composite video signal, we would discover that proper equalization of the reproduced signal would be very difficult. Additionally, the varying head-to-tape contact would produce an irregular and fluctuating signal level if we were to resort to the direct recording method.

To overcome these defects, the Videocorder utilizes a Frequency Modulation recording system which has proven to be most suitable for the recording of composite television signals from the respect of band-width availability and less level deviation effects.

The FM system employed in the Videocorder is shown in Fig. 3-8. A carrier frequency of 3 mcs with a deviation of 1 mc is utilized in this system.

To minimize distortion, the carrier frequency of 3 mcs is the resultant of the "beating" of two

3-3.4 Modulation of the Composite Video Signal (Continued)

high frequency signals. For the best S/N ratio, the depth of modulation is equal to the deviation caused by the peak-to-peak signal.

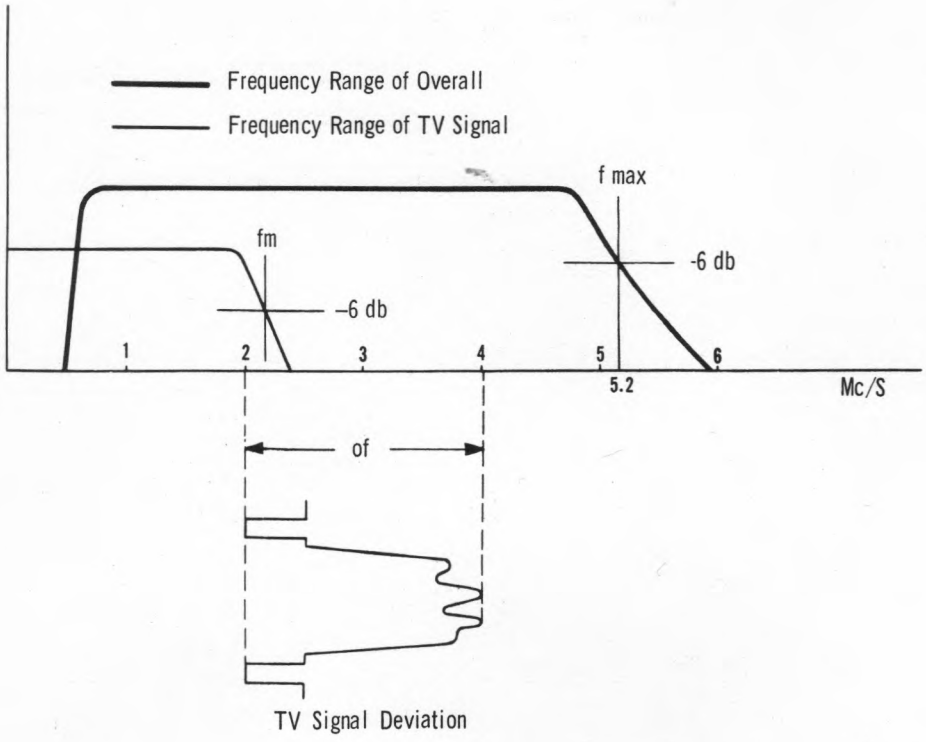


Figure 3-8.

Inasmuch as high quality heads and recording tape are provided with the Videocorder, the highest recordable frequency is very high, enabling this recording system to record both side bands of the primary harmonics of the FM signal. In essence, the Videocorder utilizes an FM recording system of comparable high modulation index, resulting in a picture with low distortion and minimum modulation noise.

3-4. COMPLETE SYSTEM DESCRIPTION (Fig. 3-9)

The Videocorder is divided into three main units.

1) Electronic System

This portion of the Videocorder processes the signals to be recorded or reproduced.

2) System Control

This portion is utilized to control the mode of operation of the electronic and mechanical assemblies.

3) Mechanical System

This system is used to control the movement of the magnetic tape in the various selectable modes of operation and to permit the transfer of signals to or from the magnetic tape.

3-4.1 System Electronics

The block diagram of the entire electronic system of the Videocorder is shown in Fig. 3-10.

In this description we will discuss this block diagram as the recorder is in playback and record modes.

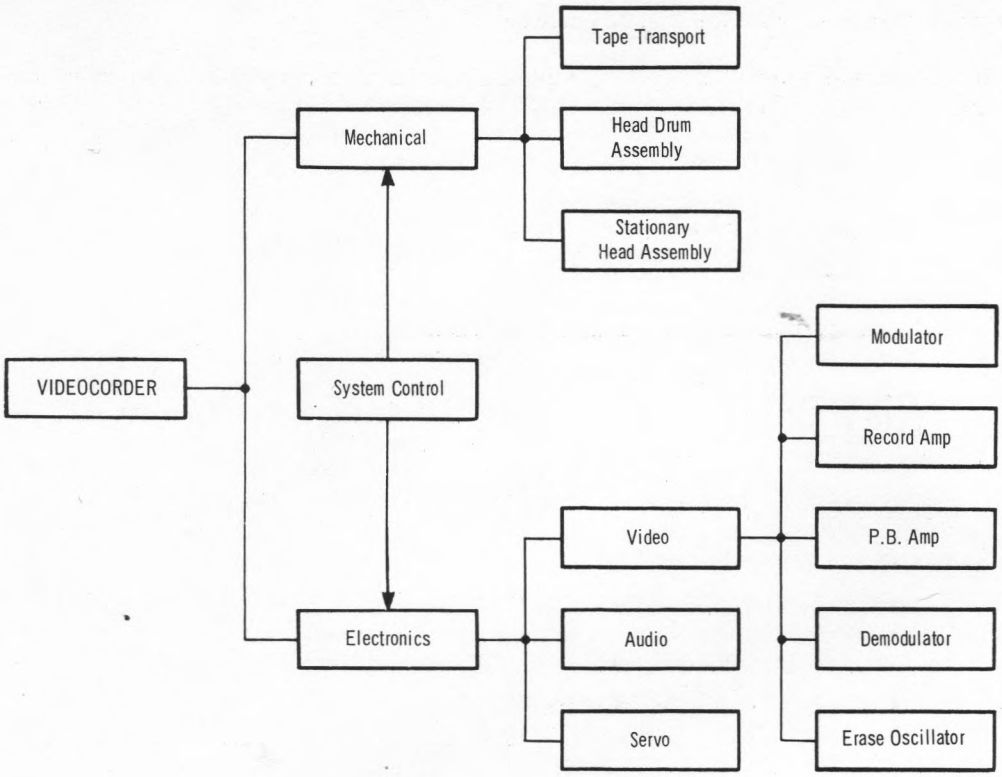


Figure 3-9.

3-4.1 System Electronics (Continued)

In order to maintain the approach of economical operation while providing the customer with superior performance the Videocorder employs many unique design approaches.

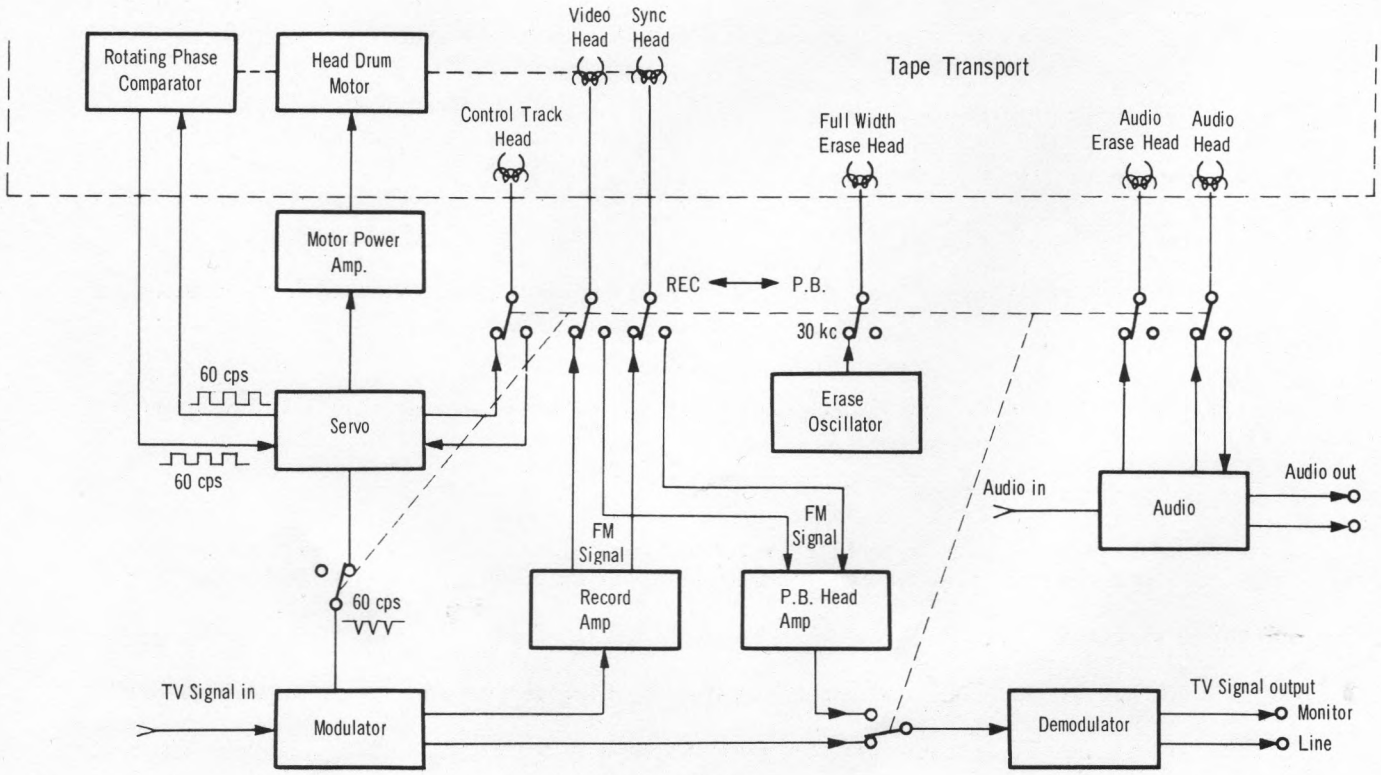


Figure 3-10.

3-4.1 System Electronics (continued)

In the Videocorder, the Servo System is only used to regulate the rotation of the head drum motor; it is not applied to the tape transport system. While in the Record mode, the head drum motor is synchronized to a 60 cps vertical sync signal derived from the composite input signal. In Playback, it is synchronized to the 60 cps signal derived from the control track.

Special processing amplifiers are not required to re-shape the output waveform of the reproduced signal because of the excellent frequency response of the video amplifier block.

Another method by which simplicity of circuit design is maintained is in the utilization of a highly sensitive and yet simple phase shift detector for the rotating head drum.

3-4.2 Record Mode

The electronic system block diagram and signal flow for the Videocorder while in record mode will now be discussed. Refer to Fig. 3-11.

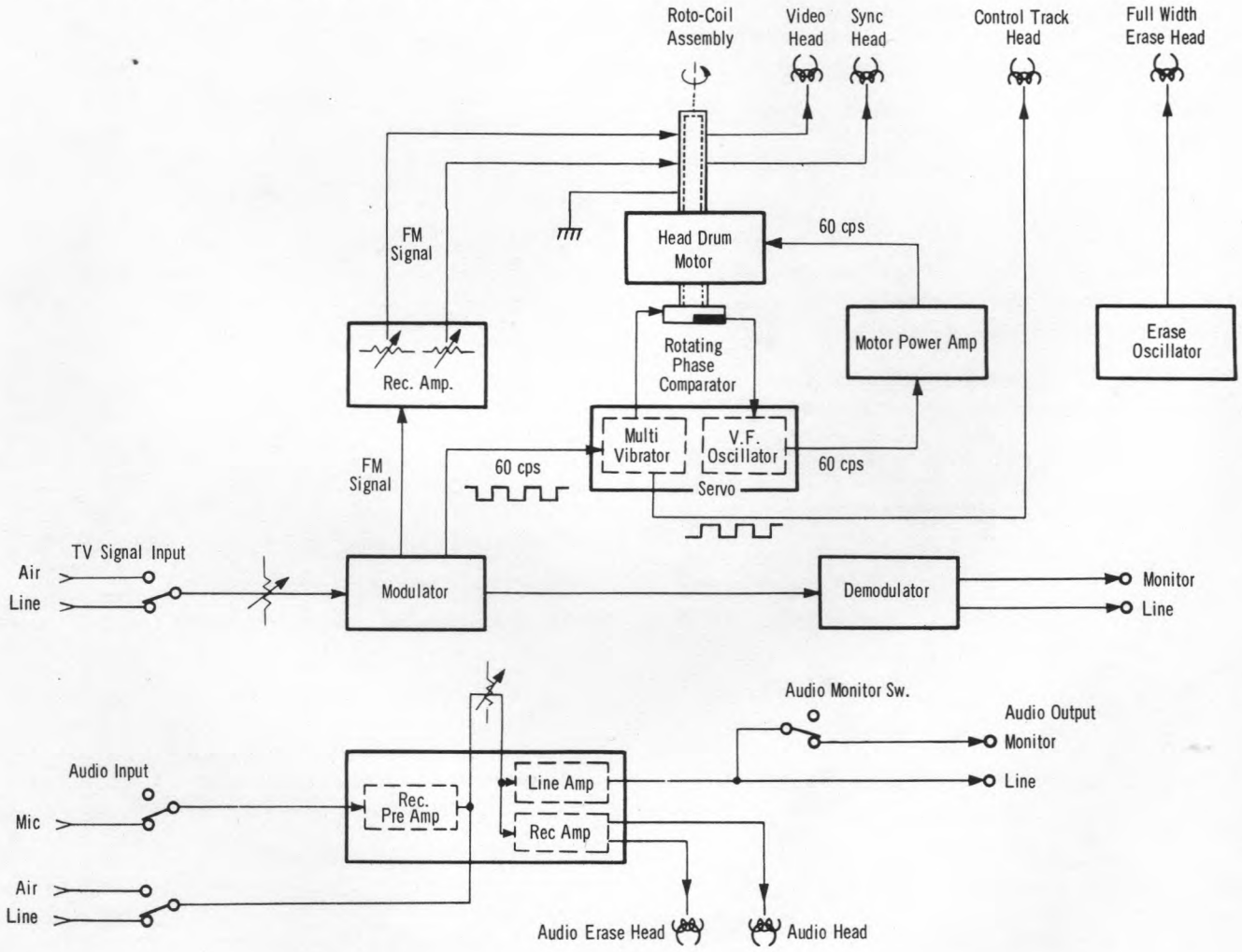


Figure 3-11.

In the Record mode, as the tape is pulled through the full-width erase head all previously recorded tracks are erased. The tape then passes around the rotating head drum where the video and sync tracks are recorded as the tape passes over the video and sync heads. The tape then goes through the stationary head assembly for the recording of the control and audio tracks.

3-4.2 Record Mode (continued)

An audio erase head is also provided on the stationary head assembly to enable the erasure of the audio track only. Activation of the AUDIO DUB Switch energizes the audio erase head.

1) Recording of a Composite Video Signal

The video signal is fed into the control panel of the machine from the input connectors on the rear panel. The signal input level is routed through the video level control on this panel, and the signal is then fed to the input of the Modulator. In this circuit, the video signal is amplified, clamped, and then FM modulates the 3 mc carrier.

Within the modulator, the amplified signal is also routed to a vertical sync sampling and separator circuit. Its vertical sync output is then fed to Servo system.

The FM signal output of the modulator is fed into a two-channel record amplifier where the signal is again amplified. It is then fed to the video and sync heads through the Roto-Coil assembly for recording on the magnetic tape.

The FM signal from the modulator is also fed to the demodulator where the signal is demodulated, thus providing complete monitoring of the recording signal.

2) Recording of the Audio Signal

The audio signal from the microphone input is amplified in the audio record pre-amplifier and then routed to the control panel for level adjustment. An audio signal fed into the LINE INPUT Jack is routed directly to the control panel.

The audio is then fed to the record amplifier for amplification and equalization. This signal is also mixed with a high-frequency bias signal derived from the audio erase oscillator and the combined audio signal is then fed to the audio head.

The audio signal appearing at the control panel audio level control is also routed to the line amplifier for an external monitoring feed.

3) Servo System in Record Mode

It is necessary to control the phase of the head motor rotation in order that the video head comes into contact with the tape during the video portion of the composite video signal and that the sync head contacts the tape during the vertical blanking period.

The phase of the head motor is controlled by referencing it to the vertical sync pulse of the input composite video signal.

A vertical sync input signal from the sync separator of the modulator is fed to the multivibrator stage of the Servo circuit to trigger the Servo. A 60 cps square wave output from the multivibrator is fed to the rotating phase comparator which is directly coupled and part of the head drum motor shaft. The 60 cps square wave from the phase comparator is varied by the phase of the head motor rotation. The resultant phase comparator output is fed to the motor power amplifier to control the rotation of the head motor.

3-4.3 Playback Mode

The electronic system block diagram and signal flow for the PV-100 Videocorder while in playback mode will now be discussed. Refer to Fig. 3-12.

1) Playback of Composite Video Signal

The pre-recorded FM signal is picked up by the video and sync heads and routed to the Playback Head Amplifier through the Roto-Coil Assembly. Here the signal is amplified and fed to the Demodulator where the FM signal is demodulated to the original composite video signal. Monitor and line outputs are available at the Demodulator output.

3-4.3 Playback Mode (continued)

2) Playback of Audio Signal

The audio signal which was recorded on the lower edge of the tape is picked up by the audio head. This signal is amplified in the audio playback pre-amplifier and then fed to the control panel where the adjustment of output level can be made. The amplified signal is then fed into the line amplifier for further amplification whose outputs are fed to the monitor and line output jacks located on the rear connector panel.

3) Servo System

Control of the head drum motor rotation in the playback mode is similar to the process discussed in the chapter on Recording. In the playback mode, the pre-recorded 60 cps control track pulse is used as the triggering input to the Servo Multivibrator.

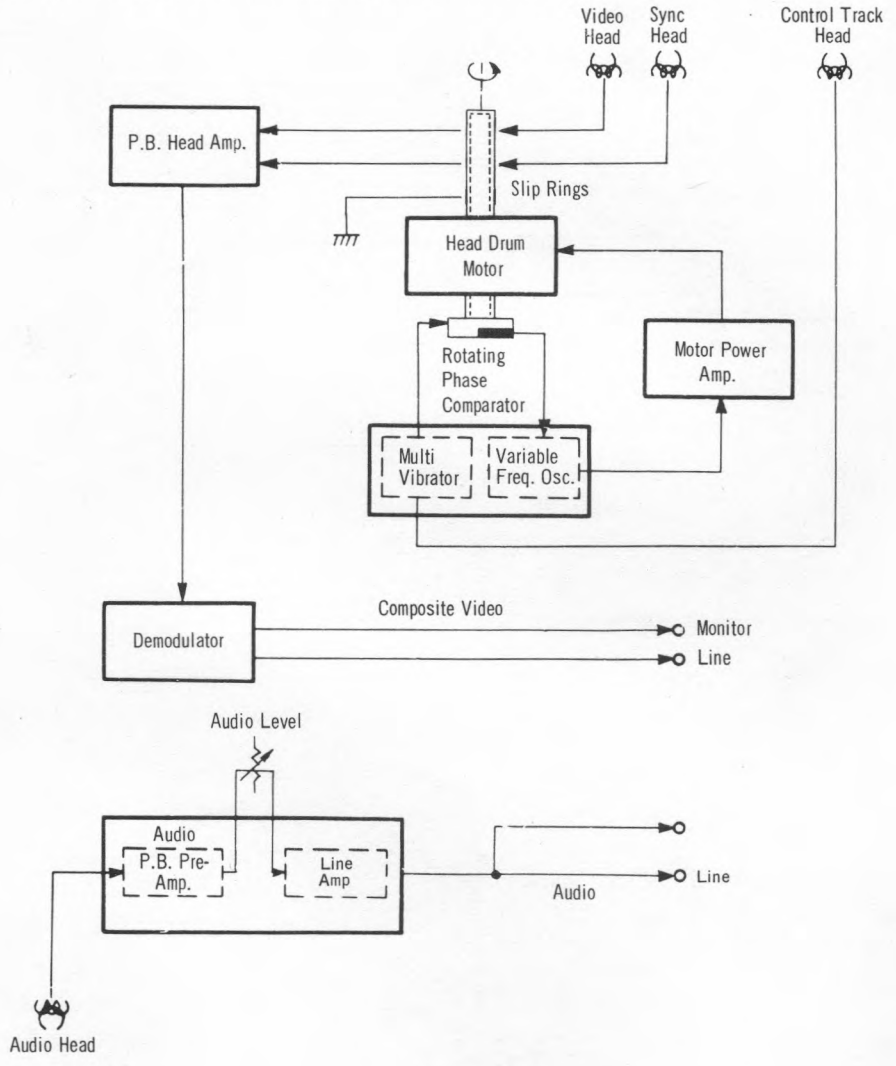


Figure 3-12.

3-5. MECHANICAL ASSEMBLY

3-5.1 General

The Tape Transport system of the Videocorder is shock mounted on a rigid metal frame. Its base plate is constructed of cast light aluminum for light-weight, but rugged construction.

All bearings utilized in the tape transport system are of the oil-sealed type, eliminating the need for frequent lubrication. Additionally, the type of oil used is designed to withstand wide ranges of environmental temperature changes.

3-5.1 General (Continued)

The Tape Transport system is comparable to that which may be used in the most expensive audio tape recorder except that the former has a rotating head drum assembly.

The Tape Transport system is designed to drive the magnetic tape ot precise speeds and to insure that proper head-to-tape contact is maintained for the recording and reproduction of a television signal.

3-5.2 Construction of the Tape Transport System

The Tape Transport system of the Videocorder is divided into three separate assemblies, as shown in Fig. 3-13. These sub-assemblies are: Tape Transport Assembly, Rotary Head Assembly, and Stationary Head Drum Assembly.

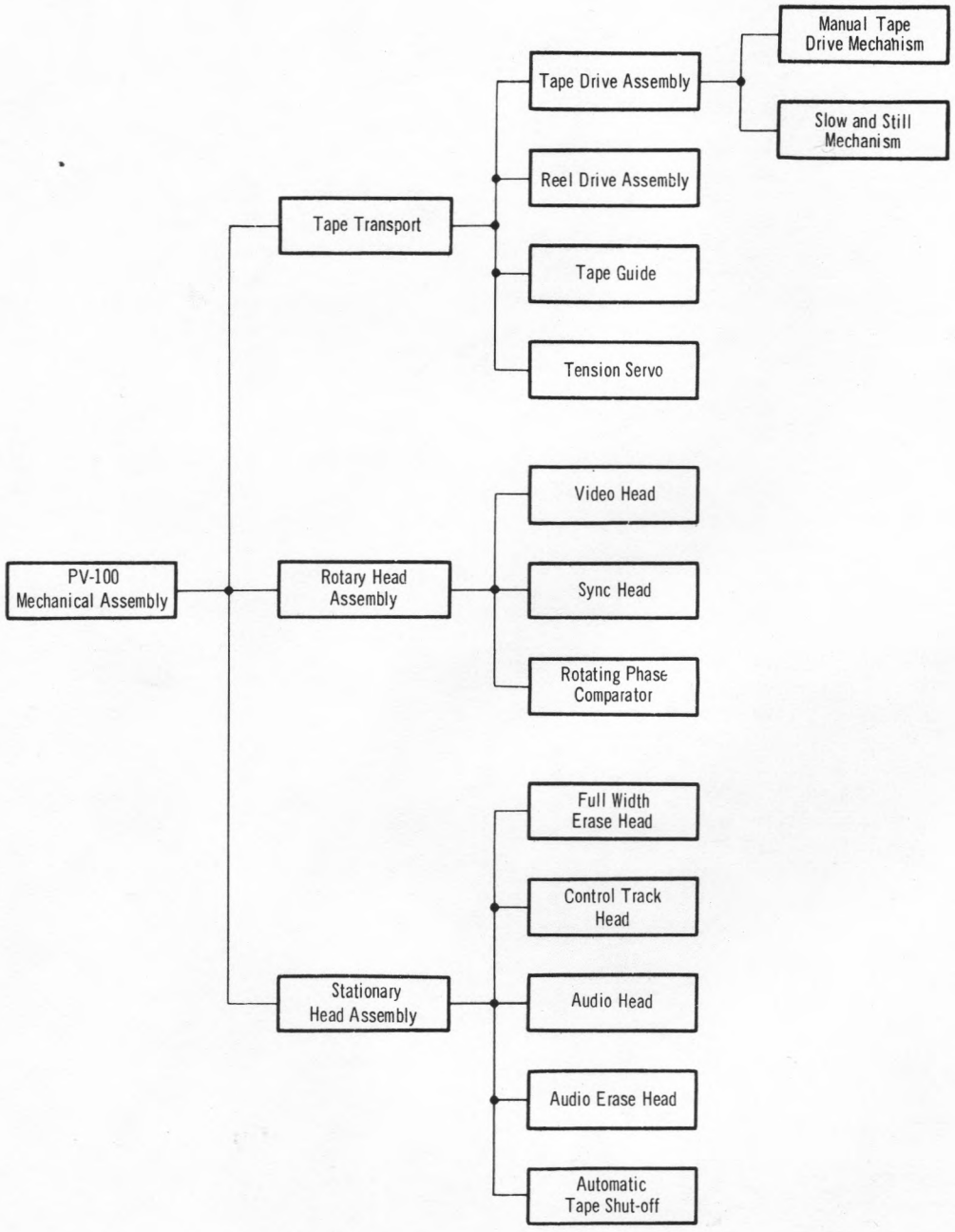


Figure 3-13.

3-5.2 Construction of the Tape Transport System (Continued)

1) Tape Transport Assembly

This assembly drives the magnetic tape by means of the Capstan and Pinch Roller at a normal speed of approximately 5.75 inches/second. The Capstan is driven by a hysteresis synchronous motor, rotating at a constand speed. In the Play and Record modes, the pinch roller is brought into contact with the rotating capstan. The magnetic tape which is located between these two rotating shafts is thereby driven past the capstan at a constant speed.

One of the outstanding features of the Videocorder is its ability to playback a video signal with the machine in STILL or SLOW MOTION operating modes. The SLOW MOTION mode is achieved by slowing the rotation of the capstan to 1/60th of its normal speed. By disengaging the pinch roller from the capstan while at this reduced speed, the STILL mode is produced.

FAST FORWARD and REWIND modes are produced by the utilization of an induction motor whose rotation can be made to be either in a clockwise or counterclockwise direction, and thereby capable of pulling the tape at fast speeds in either direction.

2) Rotary Head Assembly

The most essential function of the Videocorder is its ability to properly record/playback a composite video signal. The Rotary Head assembly provides us with the necessary components with which to accomplish this.

This assembly consists of: The Head motor, the Head Drum or disc housing the video and sync heads, the rotating phase comparator, and a set of inclined tape guides.

Each phase in the construction of this assembly must be held to extremely close tolerances and the positioning of the video and sync heads is decided by optical techniques.

The Head Motor is of the hysteresis synchronous type and it is directly coupled to the head drum. The power for the motor is supplied by the motor power amplifier. In order to maintain accurate tracking at all times the rotating phase of the motor is always detected by the phase comparator.

The video and vertical sync signals are fed to their respective rotating heads by means of the Roto-Coil assembly. Other manufacturers have to utilize a set of slip-ring and brush assemblies to achieve the transfer of energy from the input circuitry to the heads. In the SONY Videocorder, this transfer is achieved by the utilization of the magnetic induction theory, wherein two windings are effectively magnetically coupled although mechanically separated. The resultant is a noise-free transfer of energy, while at the same time providing the unit with an efficient and maintenance-free component.

The inclined tape guide rollers are used to insure that the proper slant angle of tape-to-head drum and proper head-to-tape contact is maintained.

3) Stationary Head Assembly

This assembly includes the full-width erase head, the control track head, the audio erase head, and the audio head.

Also included in this assembly is the photo-cell sensing circuitry which provides the unit with an Automatic Stop feature.

chapter IV / TEST AND MAINTENANCE PROCEDURES

4-1. GENERAL

This chapter is intended to furnish the reader with more detailed technical and mechanical information on the Videocorder. The subsequent data is divided into four sub-chapters. Adjustments to the Videocorder should not be attempted while following these brief resumes. The step-by-step adjustment procedures to be followed are those outlined in sections 4-3 through 4-5.

1) Circuit Theory on Each Printed Board Assembly

A brief technical description is presented. It is suggested that each section be read while viewing the system block diagrams and specific schematic diagrams.

2) Electrical Test and Adjustment Procedures

A complete step-by-step adjustment procedure is presented, together with test points, voltage, and wave forms available at each point.

3) Mechanical Adjustment Procedures

A complete step-by-step adjustment procedure is presented, together with drawings and photographs of all mechanical assemblies.

4) Maintenance Procedures

Suggested daily, weekly and monthly maintenance schedules are presented.

4-2.0 Circuit Theory

Each major electronic assembly is treated individually in the following segment:

4-2.1 Modulator Part 1

A composite video signal input of .5 v p-p minimum is fed to the video level potentiometer on the control panel. When measured at TP1 it reads approximately 0.45 v p-p. The modulator circuit consists of a pre-emphasis network to emphasize the high frequencies, a low-pass filter to produce a sharp cut-off of frequencies above 4.4 mcs, a clamp circuit to enable the adjustment of sync tip to 2 mcs and a white clipper for limitation of peak whites to 4 mcs. This processed composite video signal is fed to Modulator Part 2.

A vertical drive pulse is sampled from the sync pulse of the input signal and is used to supply a reference pulse to Servo Control Part 1.

The clamp circuit develops a 10 v d-c and this is used to feed both oscillators in Modulator Part 2 to insure oscillator stability.

4-2.1.1 Modulator Part 2

The outputs of two oscillators operating at approximately 50 & 52 mcs respectively are used to produce a beat frequency of approximately 2 mcs, thus establishing the FM carrier frequency. The processed video signal output from Mod. Part 1 is simultaneously fed to each of these oscillators. The resultant output of the oscillator circuitry is a frequency modulated signal with a lower frequency of 2 mcs. A low-pass filter removes the high frequency component. An R-F amplifier provides a 1 v p-p R-F signal output which, in E-E mode, is fed to Demodulator Part 1, and in RECORD mode to the Record Amplifier.

The high frequency component is filtered by L 204 and L 205.

4-2.2 Demodulator Part 1

An input RF signal of approximately 1 v p-p is fed into this board from Modular Part 1 when the machine is in E-E mode, or from the Playback amplifier when in playback mode.

4-2.2 Demodulator Part 1 (Continued)

The circuit consists of six (6) successive limiting stages to eliminate all amplitude variations of the FM carrier and to reinsert the sideband component. Two RF balancing or symmetry controls are provided, R10 on the input and R66 on the output. The output signal is an RF frequency modulated limited signal of approximately 1 v p-p and is fed to the input of Demodulator Part 2.

4-2.2.1 Demodulator Part 2

The RF input signal from Demodulator Part 1 is adjusted to .5 v p-p by the input level control R2.

After detection, the video signal is passed through a low-pass filter which eliminates any remaining carrier component. The resultant outputs are composite video signals and are adjustable by Line Out level control R47, and Monitor level control, R46.

Adjustment of any remaining carrier component is made by observing wave shape at TP-2. Adjust R5 which controls RF balance to Q2 by compensating for attenuation in delay line (crossover approximately 8-9 mcs).

Observe waveform at TP5 and adjust C7 and R28 for carrier phase balance, appearing as a line-to-line displacement in monitored picture.

Another low pass filter eliminates any remaining carrier. Adjustment of R48 is used to correct VU meter reading to zero VU when proper input level is used.

4-2.3.0 Record Amplifier

The input 1 v p-p FM signal is separated at the input and then fed to two (2) RF linear amplifiers. The channels are designated as video and sync channels, but contain identical FM signals; the levels of which are controlled by R101 and R201. Each signal is then independently fed to each recording head to produce optimum magnetization of the tape.

Adjustment of R101 and R201 is achieved by observing waveform at TP1 of Playback amplifier and with machine in Playback mode these controls are set for best playback output.

L101 and L201 effect the frequency response curve in Record mode. Controls R120 and R220 are meter correction controls and are used to establish zero VU setting on meter.

4-2.3.1 Playback Amplifier

During the Playback mode, each of the two heads detects the taped information and feeds the separate RF signals to a playback amplifier for amplification. Each RF signal is fed to individual amplifiers, but are then combined and passed through a limiter to minimize amplitude variations in the RF signal. The resultant single RF signal is fed to Demodulator Part 1. An output level of approximately 1 v p-p should be present at TP-1 if proper recording level was maintained and when playback heads are functioning properly.

An RF equalizer control, R9 is provided to permit equalization and to obtain proper bandwidth of RF signal. It will compensate for any loss incurred during record and playback process. It should be adjusted for flattest response consistent with best signal-to-noise ratio.

4-2.4.0 Servo Control System; Servo Control Part 1

The purpose of the Servo system is to control the rotating phase of the heads during record mode and to enable the recording of the vertical sync portion of the input signal by the sync head when it is coincident to vertical blanking time. In playback mode, the system is used to control the rotating phase of the heads so that the heads trace the correct tracks.

The Servo system operates on the principle of a closed feedback loop system; the loop consisting of Servo Control Part 1, Servo Control Part 2, Head Assembly (including comparator), Motor Power Amplifier part 1, and Motor Power Amplifier part 2.

Relay RY1 on Servo Control Part 1 is used to select the vertical drive pulse reference signal appearing on the input signal in Record mode, or to the signal produced by the control track on the tape during playback mode.

4-2.4.0 Servo Control System; Servo Control Part 1 (Continued)

A monostable multivibrator, triggered by either reference signal produces a symmetrical square wave which is fed to the rotating comparator in the head motor assembly, or to the control track recording head during record mode. This square wave is switched on and off by the rotation of the comparator and feeds the square wave output to Servo control Part 2.

A control track playback amplifier is located on Servo Control Part 1 and it is used to process the signal taken off of the tape by the Control Track Head. It is then fed to the multivibrator during Playback mode.

4-2.4.1 Servo Control Part 2

The square wave output from the comparator is processed through an integrator network in order to develop an error signal which is to be used to control the frequency of the diode-controlled oscillator. This error signal is limited by two diodes to control the upper and lower frequency limits of the oscillator.

The oscillator output is fed to the Motor Power Amplifier part 1 through a bandpass filter and line amplifier.

Relay RY1 is activated in SLOW and STILL modes to maintain correct and constant speed of head motor in the absence of a reference signal.

Relay RY2 is activated in any operating mode and supplies voltage to the head motor. In the E-E mode, it is released thereby removing the voltage to the head motor.

4-2.4.2 Motor Power Amplifier Part 1

This amplifier is a linear voltage amplifier and phase inverter. Its output provides two out-of-phase voltages to feed Motor Power Amplifier part 2. A potentiometer is used to control the amplitude of the input voltage.

4-2.4.3 Motor Power Amplifier Part 2

This amplifier is a single-ended push-pull power amplifier, obtaining its DC voltage from a voltage multiplier which is fed from the AC power input. The signal input from the motor power amplifier parts is amplified and the resultant power is fed to the rotary head motor, thus completing the Servo System Loop.

4-2.5 Audio System (Audio Part 1 and Audio Part 2)

This system is a conventional audio recording system. Microphone and line inputs are provided, at 600 ohm and 10,000 ohm balanced, respectively.

Audio Part 1 has a microphone input level control R14, and it is adjusted for zero VU with control at maximum and 84 db attenuation of a 1 kc signal input. Similarly, R12, line input level control is adjusted for zero VU with control at maximum and 0 db attenuation of 1 kc signal input.

To adjust bias current, place probe of VTVM at TP1 of Audio Part 2 and adjust C15 for optimum setting while machine is in Playback mode. This reading should be approximately 0.95 v.

In Audio part 1, R39 is the record equalization control and R31 is set for proper record current. Control R4 in Audio part 2 is the playback equalization control and R10 is the output level control.

4-2.6 Erase Oscillator

This is used to provide full-track erasure of the tape during RECORD mode. The oscillator is a free-running, 30 kc oscillator whose output supplies power to the Erase Head.

4-3. ELECTRONIC TEST & ADJUSTMENT PROCEDURES

4-3.1 General

The following electronic adjustment procedures are outlined for the proper operation of the Videocorder and are intended to serve as a guide and maintenance aid. Some of these adjustments are so critical that they should not be attempted without the proper test equipment and prior knowledge of the test procedures.

Your Videocorder was completely checked out & adjusted prior to its shipment to your installation and under normal circumstances should not require any of the more detailed set-up adjustments.

The following listing of test equipment is supplied only to provide you with a suggested typical equipment line-up.

(1) Oscilloscope: Tektronix 545A, with CA Dual trace plug-in, or equivalent.

(2) Test Signal Source: Generator supplying either or all of the following test signals: Stairstep, Sine-squared pulse and window, and multiburst; providing a composite test signal output Telemet 3508-A1 or equivalent.

(3) Composite video signal with standard 60 cps sync pulse.

(4) Audio Oscillator & Attenuator: Hewlett-Packard 200 CD & Hewlett-Packard 350D, or equivalents.

(5) Sinewave Generator; Tektronix 190B or equivalents.

(6) DC Voltmeter.

In order to assist you in locating the various test points and in identifying the referenced waveforms we have provided complete sections of photographs of the various modules and waveforms at the referenced test points. See chapter 5-3.

4-3.2 E-E Adjustments. (Fig. 4-1 to 4-4)

Turn power switch ON & place supply of tape on supply reel and thread. With the Videocorder in STOP mode and a composite signal fed to the input the machine is said to be in an E-E mode. That is, the video signal input is being fed to all of the electronic processing amplifiers involved in the system: Modulator Part 1, Modulator Part 2, Demodulator Part 1, & Demodulator Part 2. These will henceforth be referred to as: Mod 1, Mod 2, Demod 1, & Demod 2 respectively.

1. Clamp Voltage Adjustment

Place Video Level control on Control Panel in a CCW direction. With Voltmeter or Oscilloscope at TP3 & ground, adjust R20 on Mod. 1 to read + 4VDC.

2. Carrier Adjustment

With the video level control still in a CCW position place the oscilloscope probe at TP201 on Mod. 2 and observe waveform to be a clean sine-wave have a frequency of approximately 2.2mcs. If other frequencies are visible, adjust "Sinusoid ADJ" of each oscillator and R203 on Mod. 2. Using sweep calibrated scope, adjust F to obtain correct 2.2mc frequency.

Use a dual-trace oscilloscope, with its preamplifier in Alternate mode so that two traces may be viewed. Place polarity switch of channel A in Normal and that of Channel B in inverted position and place both probes on TP201 of Mod. 2. Attempt to superimpose the two traces by using the scope centering controls.

If the carrier adjustments previously described were performed properly, perfect superimposition of the two traces is possible. If not, then all of the previous steps outlined in Section 2 must be repeated until the resultant traces are symmetrical sine-wave waveforms which can be properly superimposed.

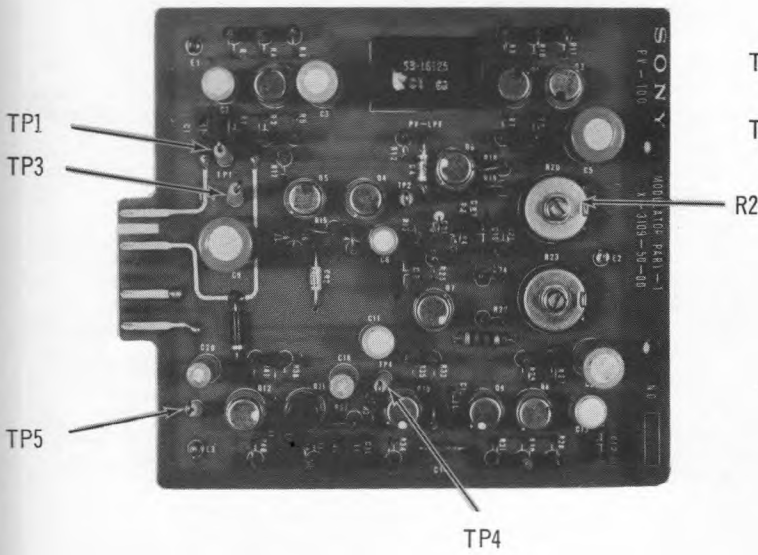


Figure 4-1. Mod. Part 1

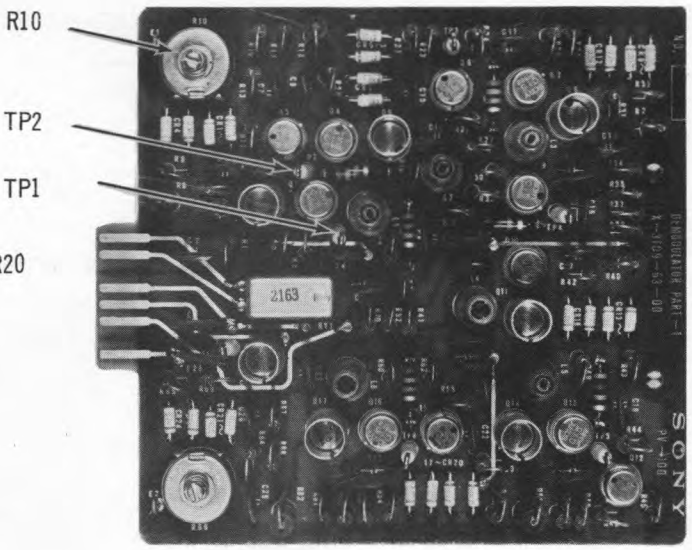


Figure 4-3. Demod. Part 1

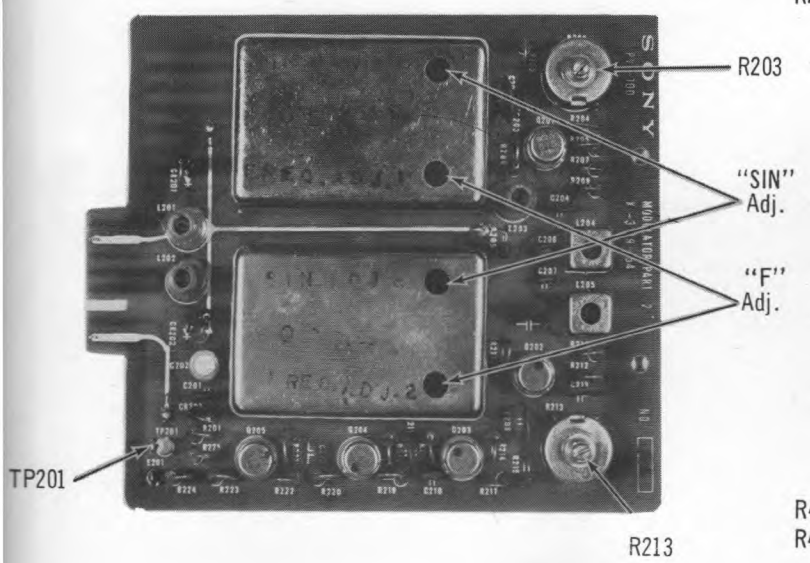


Figure 4-2. Mod. Part 2

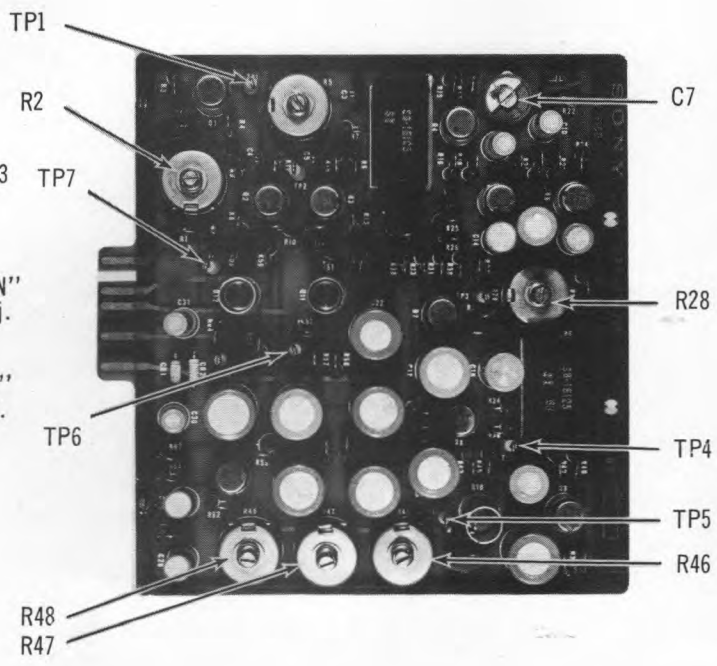


Figure 4-4. Demod. Part 2

4-3.2 E-E Adjustments (Continued)

3. Carrier Frequency and Deviation Adjustment

Feed a composite stair-step test signal into the Videocorder Video Input, and to one channel of a dual-trace oscilloscope feed a 2mc signal from standard frequency generator through a balanced mixing network to Mod. 2 TP201 and second channel of scope.

Adjust Video Level on control panel to obtain a "zero beat" occuring on the peak white pulse of the stair-step signal. This is caused by the "beating" between the carrier frequency and second harmonic of standard 2mc signal.

Adjust "F adjust" in Osc. 1 of Mod. 2 to obtain a slight indication of this beat occuring on Sync tip.

Repeat the adjustment of Video level and "F adjust" until you obtain a beat to occur simultaneously on Sync tip and peak white pulse.

This establishes proper Video level. Do not move video level control until meter is calibrated.

Place scope probe on TP1 Demod. 2 and adjust R2 to obtain 0.5 V pp. Set Meter Select switch on control panel to Vidoe Level position. Adjust R48 on Demod. 2 to the reference mark in the blue-green position of the meter scale. This calibrates the video level control.

Observe AM content on carrier waveform at TP-201 of Mod. 2 and if it exceeds 10% or is unsymmetrical, adjust R203 on Mod. 2.

4. RF Output Adjustments

Maintain signals and levels as set forth in section 3 and place scope probe at TP201 Mod. 2. Adjust R213 to obtain 1V p-p level. If unable to obtain proper RF output, repeat steps outlined in sections 2 and 3.

5. Waveform Balance Adjustments

Check all test points on Demod. 1 to make certain that all circuits are functioning properly. Set Video level control on Control Panel to CCW position.

MOVE OSCILLOSCOPE PROBES TO TP7

Connect both oscilloscope probes to TP2 on Demod. 1 and adjust R40 to obtain best balance or trace superimposition (connect as previously described in section 2, Carrier Adjustment).

6. Carrier Balance Adjustment

Set Video level control to established meter reading. Place scope probe at TP5 of Demod. 2 and adjust C7 & R28 to minimize the leakage of high frequencies appearing as hash on the tip of sync.

7. Video Output Adjustments

Place scope probe at TP6 on Demod. 2, and with proper Video level input (section 6) adjust R46 (Mon. out) for 1.4v p-p. With probe at TP7 adjust R47 (LINE OUT) for 1.4v p-p.

Before proceeding to section on Servo System adjustments check TP4 & TP5 on Mod. 1 for vertical drive pulses to insure that the Sync Separator circuitry is functioning properly.

4-3.3 Servo System Adjustments (Fig. 4-5 to 4-8)

The Videocorder Servo system consists of: Servo Part 1, Servo Part 2, Motor Amplifier Part 1, Motor Power Amplifier Part 2, Head Motor (with phase comparator), & Control Track Head. In the following description these will be referred to as: Servo 1, Servo 2, MPA 1, MPA 2, Head Motor, & Control Track Head, respectively.

With any composite video input feeding the Videocorder, place machine in RECORD MODE.

1. Place probe at TP1 of Servo 1 & check for vertical drive pulse from Mod. 1.

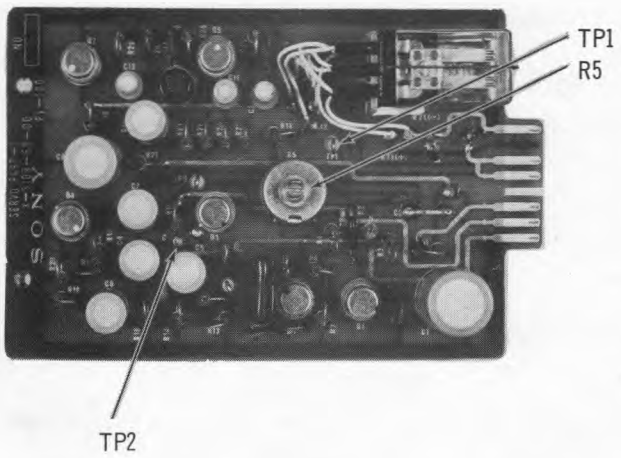


Figure 4-5. Servo Part 1

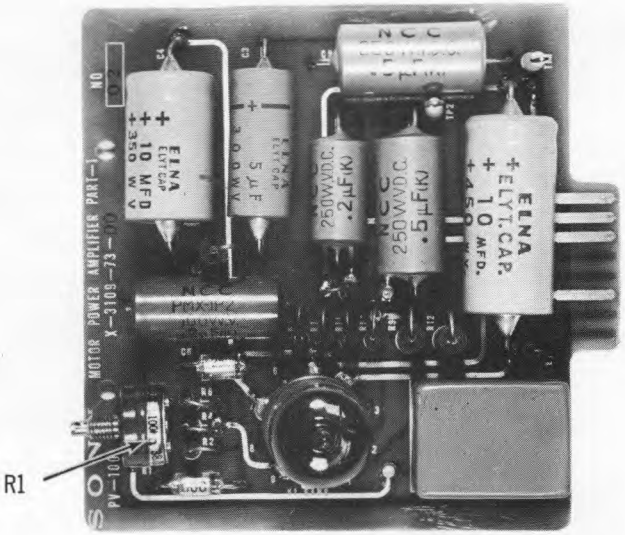


Figure 4-7. Motor Power Amp. 1

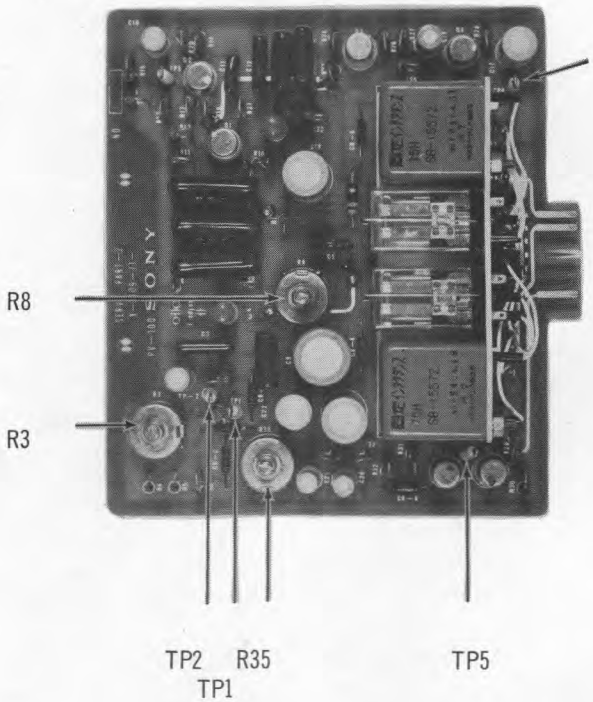


Figure 4-6. Servo Part 2

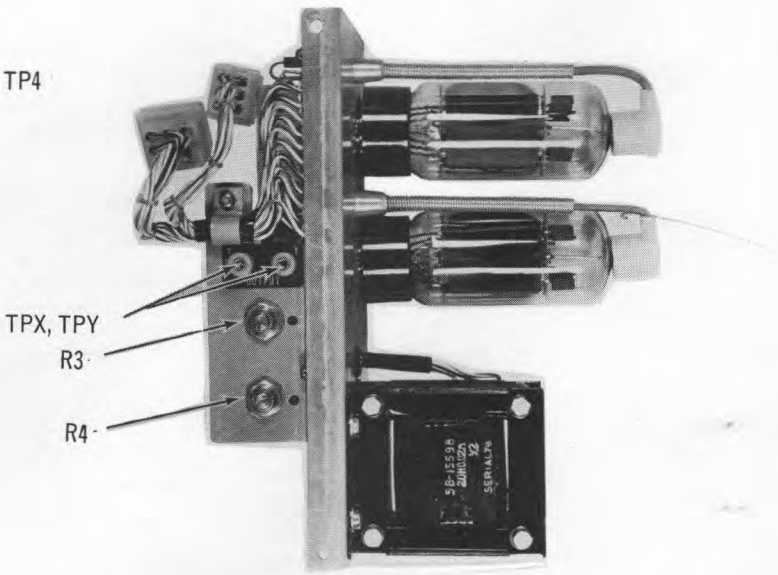


Figure 4-8. MPA 2

4-3.3 Servo System Adjustments (Continued)

2. Multivibrator Adjustment.

Connect scope probe to TP2 of Servo 1 and adjust R5 to obtain a square wave with a 1:1 ratio.

3. Center Frequency Adjustment.

On Servo 2, short TP1 & TP2 together. Lock the oscilloscope horizontal sweep rate by using the vertical drive pulse at TP1 on Servo 1. Connect scope probe to TP4 on Servo 2 and check for a 60 cps sine wave.

Slowly adjust R8 on Servo 2 until the wave form drift period, prior to its "locking" to the scope trigger, occurs in more than 5 seconds.

4. Lock Phase Adjustment

Connect scope probe to TP5 on Servo 2 and adjust R3 to obtain a square wave having a 1:3 ratio.

5. Hunting Adjustment.

With the scope probe on TP5 of Servo 2 momentarily "thumb" the head motor drum. You will notice that the wave form at TP-5 will momentarily fall-out of lock and "hunt" until settling down. Adjust R35 until this "hunt" and "lock" time period does not exceed 3 seconds.

6. Place Videocorder in Play Mode.

Connect scope probe to TP1 of Servo 1 & check for control track output.

Move scope probe to TP5 of Servo 2 to check for evidence of "hunting". If it is severe, refer to chapter on Tape Transport Mechanical Adjustments, and re-check setting of R35 on Servo 2.

7. Return Videocorder to Record Mode.

The following adjustments apply to the Motor Power Amplifiers. Set Meter Selector switch to MOTOR position.

Adjust R1 and MPA1 to obtain meter reading in center of blue-green scale range. This sets the correct motor voltage for the Head Motor. To adjust bias, connect scope probes between TPX & TPY on MPA-2. Oscilloscope should be set to differential mode. Waveform should be a pure sine wave. If not, adjust R3 & R4 on MPA-2 to obtain a sinusodial pattern.

With meter, or oscilloscope, check DC voltage between TPX & TPY & readjust R3 & R4 for zero volts ... Check with machine in RECORD and STOP modes.

4-3.4 Record and Playback Adjustments (Fig. 4-9 to 4-10)

Feed a composite window or stairstep test signal to Video Input of Videocorder. Connect a microphone into MIC-IN jack. Set video & audio levels to proper operating points.

1. Record Current Adjustments

This series of adjustments will result in determining the optimum operating parameters of the video & sync heads, and therefore, should be repeated whenever these heads are replaced.

On Record Amplifier, turn R101 completely CCW & push Slide switch to the left (Video head) position.

Set control panel meter selector to REC-CURRENT position. Place Videocorder in RECORD mode.

While observing the meter, turn R101 for a current reading to the first meter scale indication and into the microphone say..."POSITION 1".

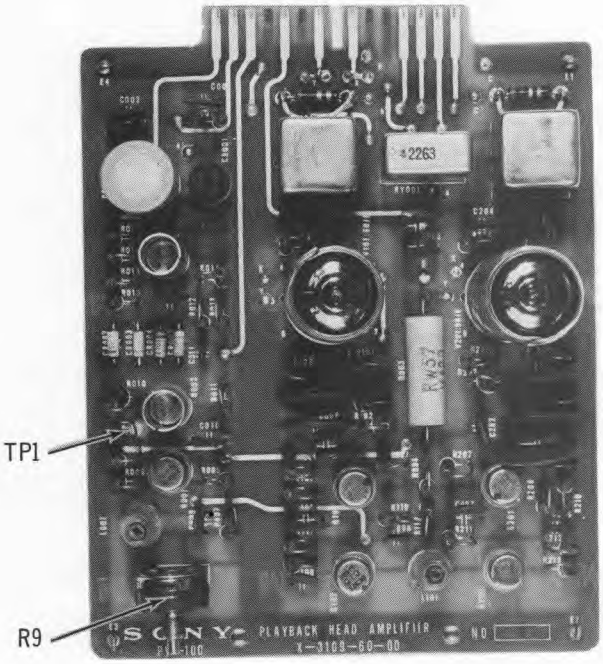


Figure 4-9. Playback Head Amplifier

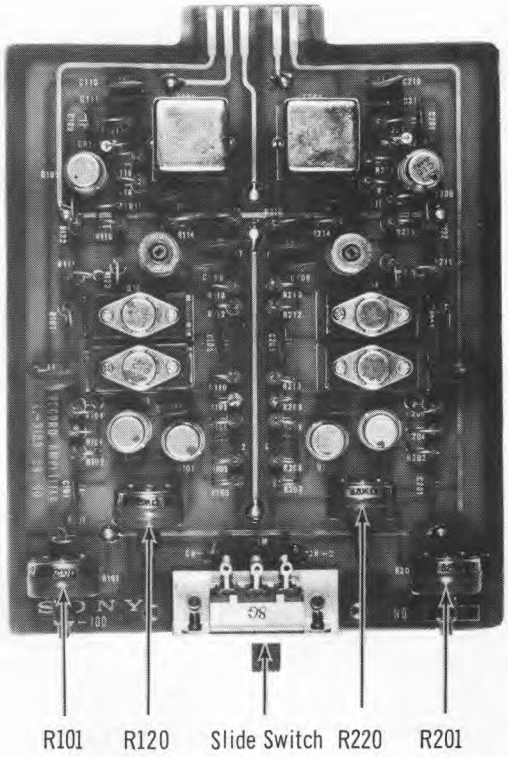


Figure 4-10. Record Amplifier

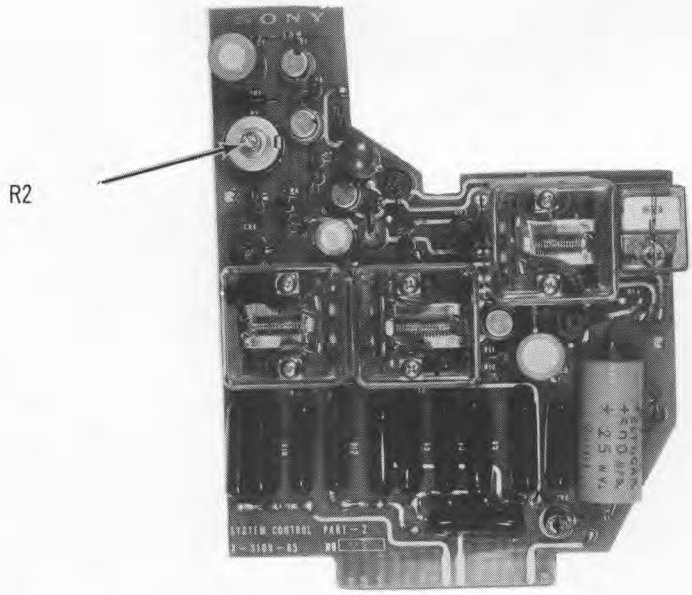


Figure 4-11. System Control Part 2

4-3.4 Record and Playback Adjustments (Continued)

Turn R101 to obtain a reading to the second meter scale indication & into the microphone say..."POSITION 2".

Repeat this procedure for seven or eight settings, recording segments of approx. 5-10 seconds duration at each setting.

STOP the machine. Place oscilloscope probe on TP-1 on Playback Head Amplifier and connect available audio monitor to machine. Place machine in PLAY mode.

Observe the output envelope presentation on the scope, noting the setting (visually and aurally) producing an RF envelope of maximum amplitude, flat response, and minimum AM noise content. This is the optimum setting for this particular video head.

Place Videocorder in RECORD mode and set R101 to that setting on meter which produced optimum envelope presentation (position 2, 3, 4 etc.) Adjust R120, also on RECORD AMP., to obtain meter scale indication in the blue-green range. Record a segment of tape at this optimum setting. Place PV-100 in STOP mode.

On Record Amp., push-slide switch to the right (sync head) and turn R201 completely CCW.

Place machine in RECORD mode & repeat the steps outlined above in order to establish optimum sync head parameter. The controls affected in this instance are R201 & R220. Set R201 to the optimum setting & then adjust R220 to obtain meter scale indication in the blue-green range. Record a segment of tape at this optimum setting. Place Videocorder in STOP mode.

2. Equalizer Adjustment

Place the machine in PLAY mode & playback the signal recorded with optimum record current settings.

Turn R9 on PLAYBACK Head Amp. completely CW. With scope probe at TP-1 of this amplifier, slowly turn R9 CCW and set at the position producing a clean RF envelope.

4-3.5 Audio System Adjustments (Fig. 4-12, 4-13)

Place machine in STOP mode. Feed an audio oscillator signal into MIC INPUT. This should be 1000 cps @ a - 80 dbm input. Set Meter Selector switch to AUDIO LEVEL position.

Set AUDIO LEVEL control on Control panel to extreme CW position. Adjust R14 on Audio Part 1 to obtain a reading of 0 VU on meter.

Change input signal to a - 70 dbm level and adjust AUDIO LEVEL control on Control Panel for a 0 VU meter reading. Do not move level control from this position until this series of adjustments is completed.

Feed an 1000 cps audio signal @ +4 db to LINE INPUT of Videocorder. Adjust R12 on Audio Part 1 to obtain 0 VU reading on meter.

Place machine in RECORD mode and record a segment of tape with a 1000 cps tone @ 0 VU level.

With Videocorder in PLAY mode, playback the segment of tape with the audio recording. Adjust R10 on Audio Part 2 to obtain a reading of 0 VU on meter.

4-3.6 System Control Adjustments (Fig. 4-11)

On System Control Part 2, adjust R2 to set the Head Motor build-up time for 3 seconds. This is accomplished by placing the machine in STOP mode & then noting length of time required for picture to stabilize upon activation of machine in PLAY mode. Repeat until maximum build-up time does not exceed 3 or 3.5 seconds.

4-3.7 Power Supply Adjustments

The only required adjustment is to the regulated 24 V DC supply, Power Supply Part 2, Adjust R208 to obtain this reading with a DC meter on points TPH and TPGH.

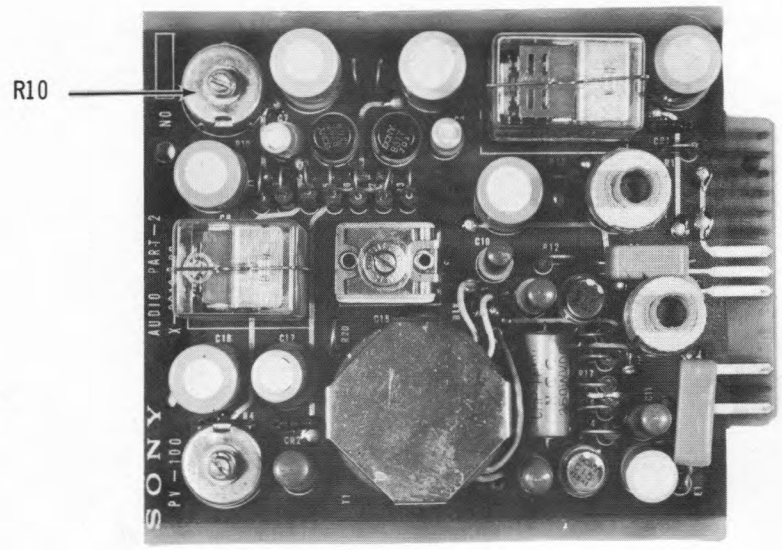


Figure 4-12. Audio Part 2

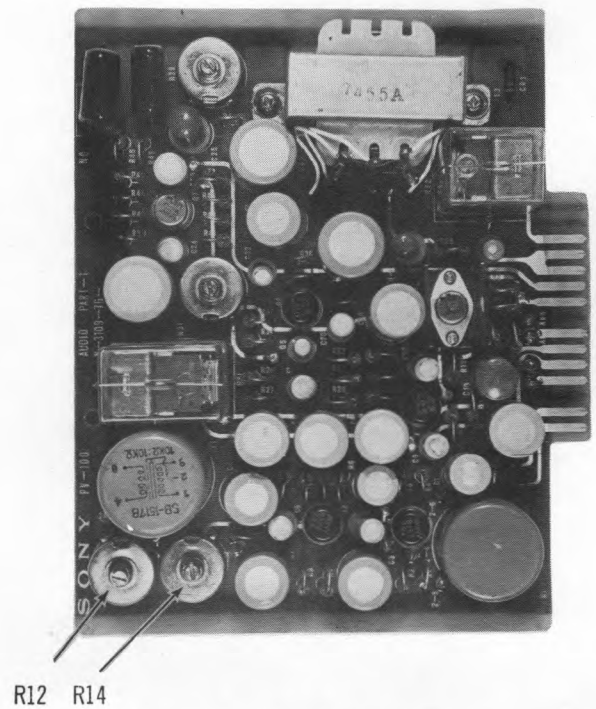


Figure 4-13. Audio Part 1

4-4. MECHANICAL ADJUSTMENT PROCEDURES

4-4.1 General

The following mechanical adjustment procedures for the Tape Transport Assembly of the Videocorder are set forth to assist you in obtaining a better understanding of the Tape Transport system and to serve as a maintenance guide should remedial steps become necessary.

It is recommended that the below listed tools be available before attempting any of the mechanical adjustments. The tools and equipment listed below are available from Sony as a complete Mechanical Adjustment tool kit:

1) Tension gauges: 0-500 grams
   0-2000 grams
   0-10,000 grams
2) Flat screwdrivers, assorted blades
3) Phillips screwdrivers, assorted blades
4) Hex nut drivers, assorted sizes
5) Spanner wrenches
6) Feeler gauges
7) Empty tape reel, prepared as per Fig. 4-22
8) Reel knob
9) Tape-transport frame and extension cables
10) Standard alignment tape

4-4.2 Slow Motion Idler Assembly Adjustment

1. Remove Capstan Motor amp-lok connector
2. Remove Capstan Motor wiring assembly as shown in Fig. 4-14.
3. Place Videocorder in PLAY mode and observe that pivot "C" (Fig. 4-15) is in center of opening "D". This position is adjustable by screws "A" and "B".
4. Place Videocorder in STOP mode.
5. Refer to Fig. 4-16. Note that the SLOW MOTION IDLER WHEEL must not be in contact with Capstan fly-wheel, as noted by "x".
6. Similarly, the BRAKE PULLEY should not touch the frame of the SLOW MOTION IDLER. Should adjustment be required, reposition by varying "D".
7. Place Videocorder in PLAY mode.
8. Refer to Fig. 4-17. Using the 0-2000 gm tension gauge, remove spring "A" from upper retaining shaft and measure spring tension required to expand spring to center of its retaining shaft. This should be 1500 grams. Physically adjust spring until the desired tension is achieved. Remove gauge and return spring to its retaining shaft.
9. Reassemble capstan motor wiring frame and connect amp-lok connector to capstan motor.

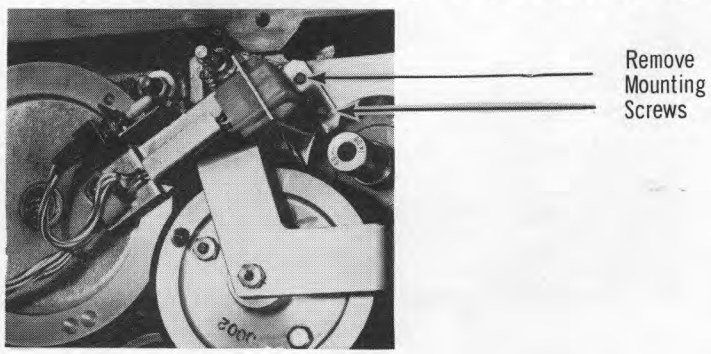


Figure 4-14.

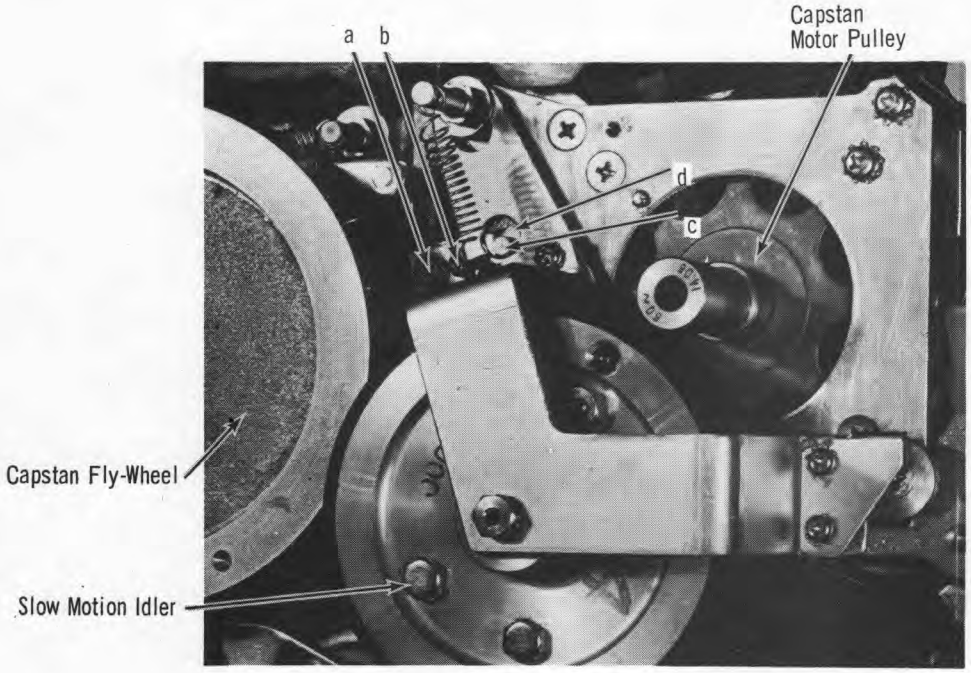


Figure 4-15.

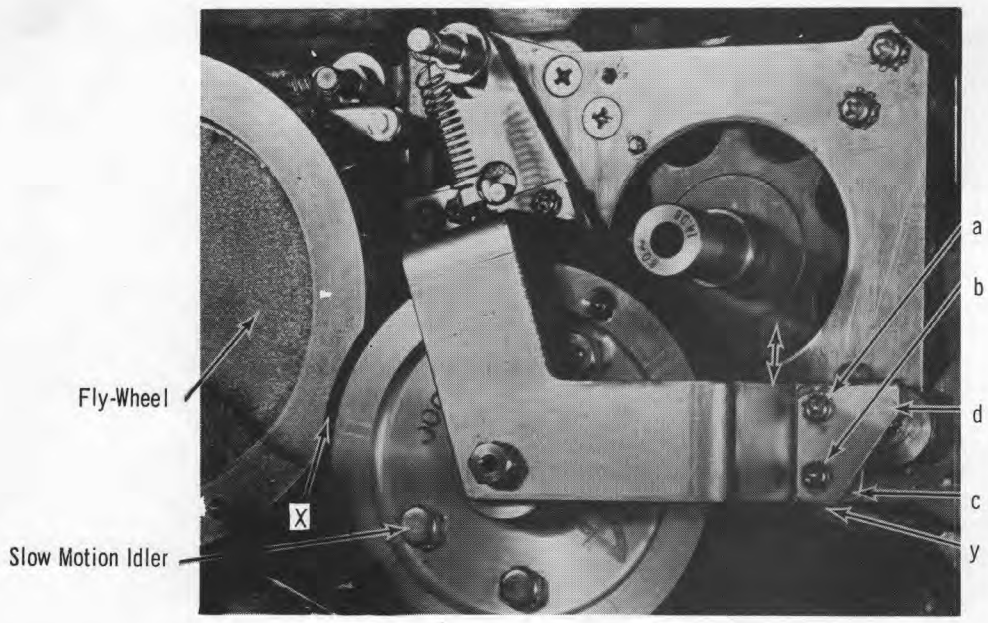


Figure 4-16.

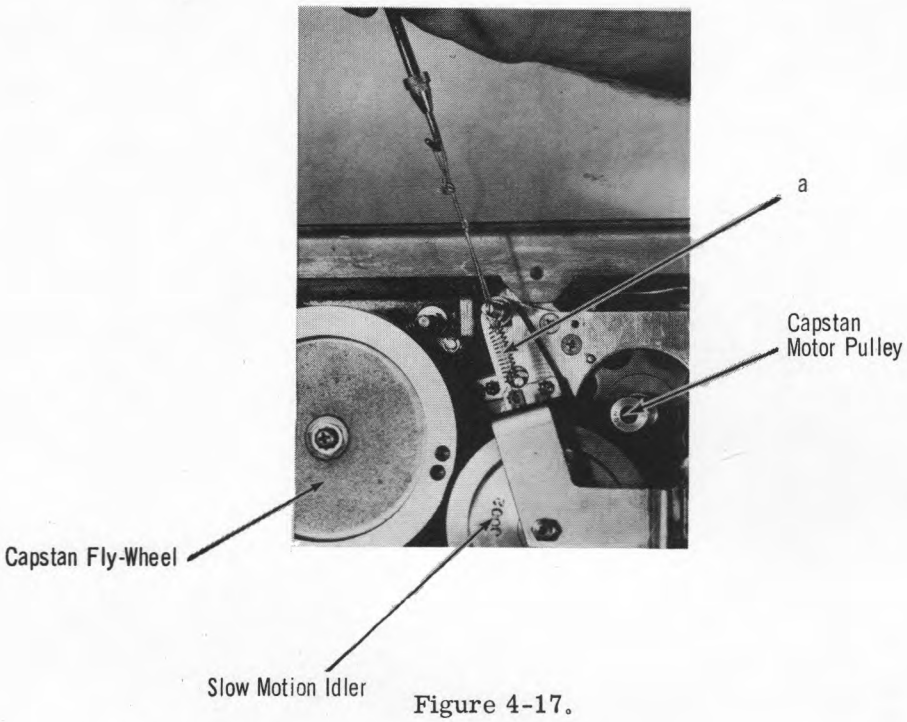


Figure 4-17.

4-4.3 Brake Position Adjustment

Brake Solenoid Stroke Adjustment

1. **Place Videocorder in STOP mode.**
2. **Refer to Fig. 4-18.** Loosen the 3mm Cap Screw on the Brake Arm Adj. Plate **and depress the solenoid plunger** to its maximum point of compression.
3. **Release for a measurement of 2mm.**
4. **Hold plunger in this position.** Manually push Brake Arm against the **brake drum of Reel Shaft and tighten the 3mm cap screw.**

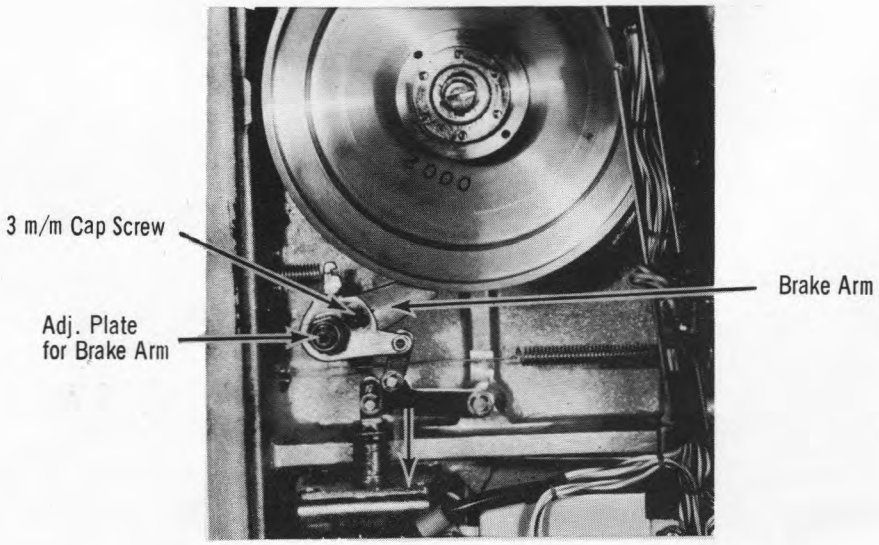


Figure 4-18.

4-4.3.1 Brake Arm Thrust Play Adjustment

1. Refer to Figs. 4-19 and 4-20 showing side view of Brake Drum and Shoe Arm Assembly.
2. With Videocorder in STOP mode loosen the 5mm retaining nut on the brake shoe shaft until the Brake Shoe Assembly is centered within the Brake Drum.
3. Insert an 0.1mm gauge between the shaft washer and retaining nut to insure proper thrust play.

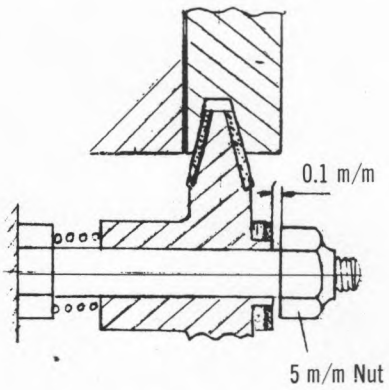


Figure 4-19.

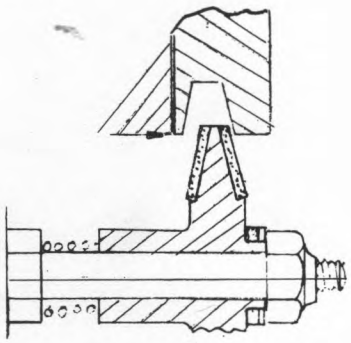


Figure 4-20.

4-4.4 Friction Lever Lining Adjustment

Friction Brake Shoe Gap Adj: Fast Forward, Rewind Modes

1) Remove amp-lok connector to Reel Motor and place Videocorder in FFWD mode.
2) Using the 1.5mm feeler gauge, check for correct gap spacing between Take-up Reel brake pulley and friction brake shoe (see Fig. 4-21).
3) When adjustment is required, lossen screws "A" to obtain correct spacing.
4) Place Videocorder in RWD mode and similarly check for 1.5mm gap on Supply Reel.

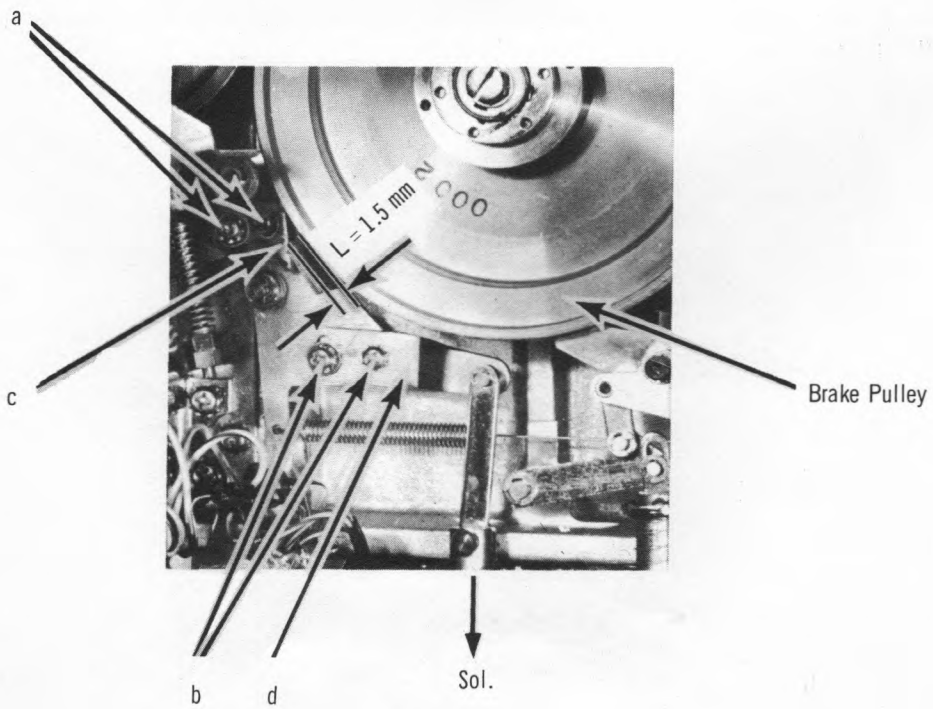


Figure 4-21.

4-4.4.1 Friction Brake Shoe Gap Adj: Play and Record Modes

1. Reconnect amp-lok connector to Reel Motor and place Videocorder in PLAY mode.
2. Using 2mm feeler gauge check for correct gap spacing between Take-up Reel brake pulley and friction brakeshoe, (see Fig. 4-21).
3. When adjustment is required, loosen screws "b" to obtain correct spacing.
4. Place Videocorder in REC mode and check that 2mm spacing has been maintained.
5. Repeat procedures 2 through 4 for Supply Reel.

4-4.5 Torque and Friction Adjustment, Take-Up Reel

Brake friction adjustments for Take-up reel side must be made in the following order:

1. Friction brake in RWD
2. Stop brake in STOP at CW
3. Stop brake in STOP at CCW
4. Take-up torque in PLAY

4-4.5.1. RWD Friction Brake Adjustment

1. Place empty test reel on take-up shaft, and lock into position with REEL KNOB.
2. Wind cord in a CCW rotation and attach 0-500 gm. tension gauge to looped end of cord. Ascertain that gauge is held in a position horizontal to base plate of machine. See Fig. 4-22.
3. Place Videocorder in RWD mode.
4. Slowly pull on tension gauge (at a rate of approx. 1/4"/sec.)
5. Tension guage should read 200 grams.
6. Should adjustment be required, turn RWD FRICTION adjusting nut (using 5/32 Hexdriver) until proper tension is obtained. This is located on the Right side of the Tape transport baseplate (see Fig. 4-23) Place Videocorder in STOP mode.

   NOTE: Reel motor should be idled for cooling if operated for more than 5 min. in fast winding modes.

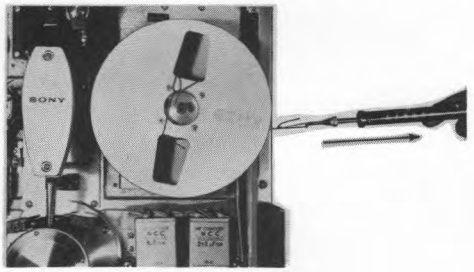


Figure 4-22.

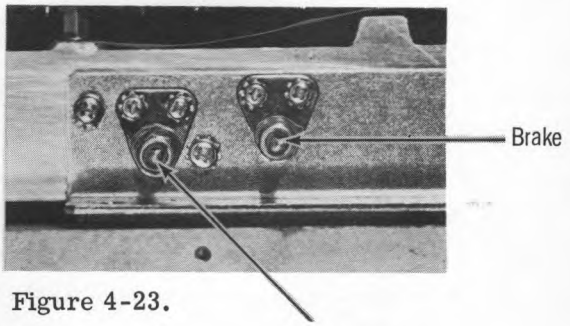


Figure 4-23.

4-4.5.2 Stop Brake, CW Adjustment

1. Rewind the lacing cord on empty test reel in a CW direction.
2. With Videocorder in STOP mode check torque by attaching the 0-500 tension gauge to looped end of cord. Ascertain that the gauge is held in a position horizontal to base plate of machine, and slowly pull on tension gauge (rate of 1/4"/sec).
3. Gauge should read 400 grams. Adjust BRAKE adj. nut (located on the RIGHT side of the tape transport mechanism, to the right of the Friction nut adjustment, until proper tension is obtained.

4-4.5.3 Stop Brake, CCW Adjustment

1. Rewind the lacing cord on the empty test reel in a CCW direction (Fig. 4-22).

2. With the Videocorder in STOP mode, and using the 0-2000 gram tension gauge as previously described, check for a reading on gauge of 1300 grams, ± 100 grams.

3. Refer to Fig. 4-24 in the event that adjustment is required.

4. The special spanner wrenches should be attached to the rear of the Disc Brake Wheel as shown, and by moving the wrenches either away or toward each other in a CW or CCW the proper brake tension can be attained.

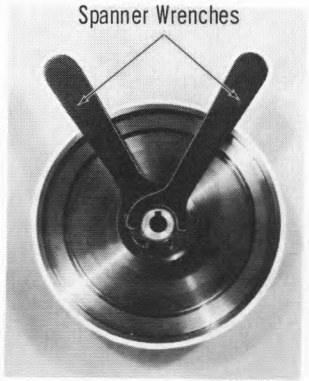


Figure 4-24.

4-4.5.4 Take-Up Torque Adjustment

NOTE: It is important that input AC voltage is maintained at 117 v during this test.

a) Wind the lacing cord on the empty test reel in a clockwise direction.

b) Attach the 0-500 gram tension gauge to the looped end of the cord.

c) Place Videocorder in PLAY mode.

d) Tension gauge should read 250 gram tension.

e) Should adjustment be required, STOP machine, move the sliding band content of Resistor "A" after loosening with a screwdriver. (Fig. 4-25) Place Videocorder in PLAY mode and recheck reading on tension gauge...repeat as required.

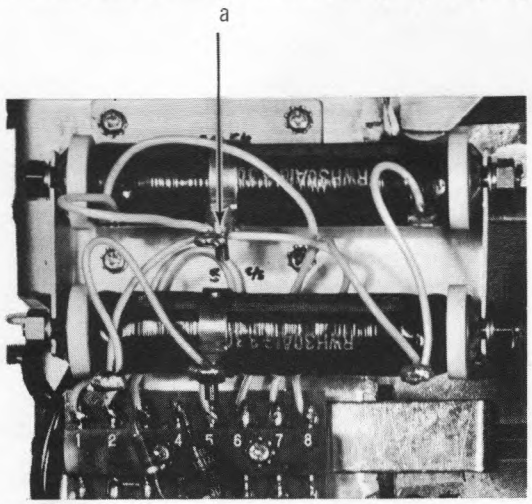


Figure 4-25.

4-4.6 Torque and Friction Adjustments, Supply Reel Side

Brake friction adjustments for supply reel side must be made in the following order:

Supply Side: 1. Friction brake in FFWD
2. Stop brake in STOP at CCW.
3. Stop brake in STOP at CW.
4. Tension brake in PLAY

4-4.6.1 FFWD Friction Brake Adjustments

1. See Fig. 4-22
2. Refer to test procedure described in para. 4-4.5.1 and repeat for supply side.

4-4.6.2 Stop Brake, CCW Adjustment

1. Refer to test procedure described in para. 4-4.5.2. However, wind lacing cord in a counter-clockwise direction.

4-4.6.3 Stop Brake, CW Adjustment

1. See Fig. 4-22
2. Refer to test procedure described in para. 4-4.5.3 and repeat for supply reel side. However, wind lacing cord in a clockwise direction.

4-4.6.4 Tension Brake Adjustment, Play Mode

1. Place empty test reel on supply reel shaft and wind cord in a clockwise direction.
2. Attach 0-500 gram tension gauge to looped end of cord and pull gauge in a horizontal plane away from supply reel.
3. Place Videocorder in PLAY mode.
4. Gauge should read 250 grams.
5. Refer to Fig. 4-26 should adjustment be required. Turn screw adjustment referred to in this figure CW or CCW until proper brake tension is obtained.
6. In the event that this screw adjustment has reached its maximum excursion and you are still unable to obtain proper tension, additional procedures must be followed. Please refer to Figs. 4-27 to 4-29.
7. STOP Videocorder and remove test reel.
8. In order to obtain more range of adjustment for tension brake adjustment, tension brake shaft "C" holding brake shoe is repositioned by simultaneously loosening nuts "B" and "E" with 5/32" spanner and hex wrenches respectively.
9. Check that space "t" (Fig. 4-29) is never less than 0.5 mm.
10. Install test reel and utilize tension guage as described in para. 2, placing Videocorder in PLAY mode. Repeat procedures described in para. 2 through 8 until proper tension brake adjustment is obtained.

4-5. MAINTENANCE PROCEDURES

4-5.1 General

Under normal operating & environmental conditions the Videocorder will not require any special maintenance service. Generally, the only requirement is the routine cleaning and demagnetization of the heads. All of the bearings in the mechanical assemblies are oil-sealed types, designed to operate indefinitely without lubrication.

PRECAUTION

Make certain to set Power Switch to OFF position before attempting to perform any maintenance operations.

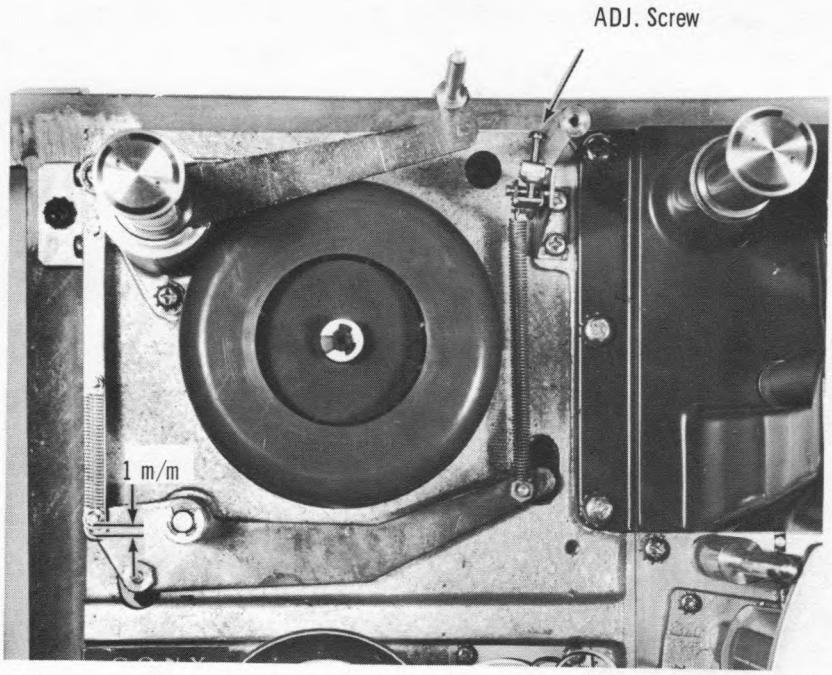


Figure 4-26.

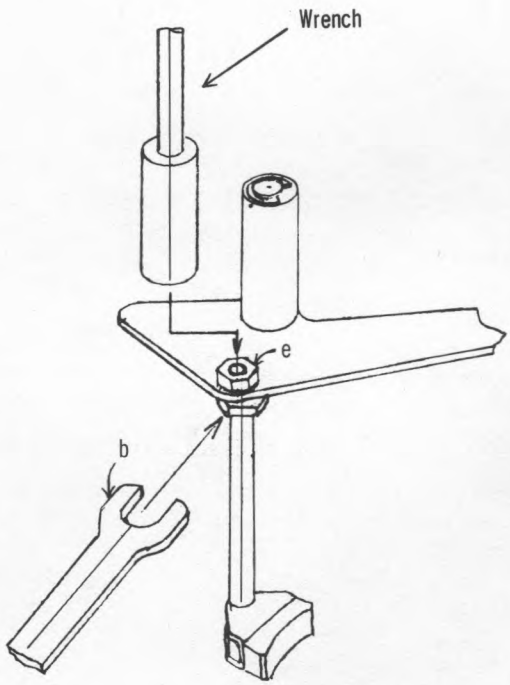


Figure 4-27.

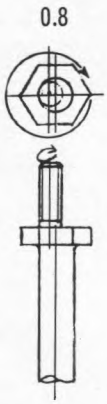


Figure 4-28.

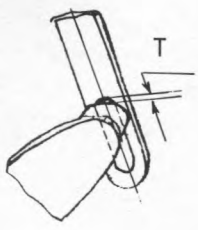


Figure 4-29.

4-5.2 Daily - Weekly Maintenance

1) Clean all exposed surfaces of the various mechanical assemblies of the Videocorder by wiping them with a soft dry cloth.

2) After each operation clean the surface of each signal head with the chamois cloth furnished with the Videocorder. If any tape residue is present, slightly moisten a portion of the cloth with alcohol to clean the heads. Refer to Figs. 4-30 & 4-31. Similarly, clean the capstan & pinch roller.

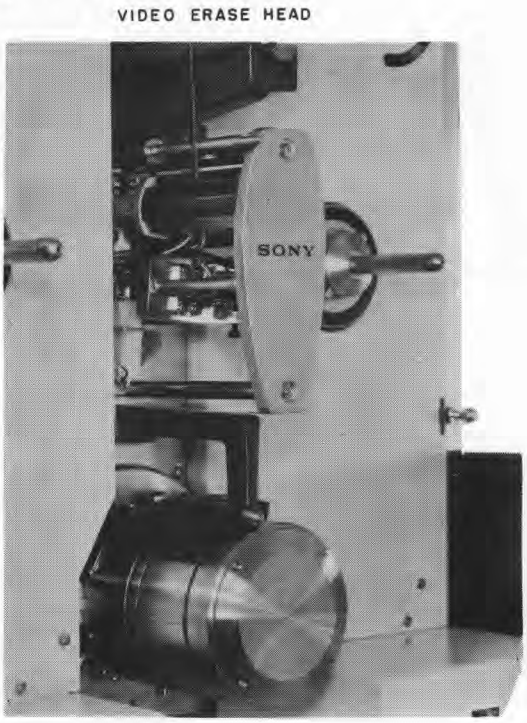


Figure 4-30. Full-Width Erase Head

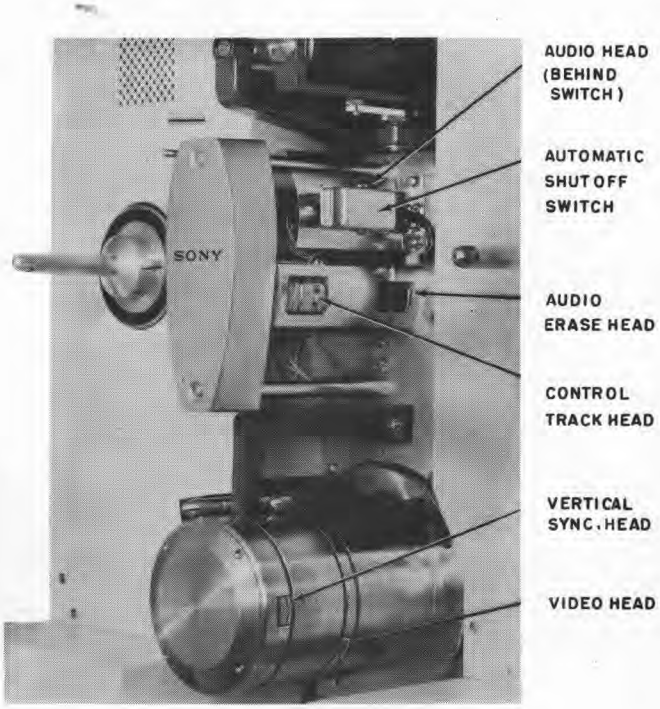


Figure 4-31. Location of Heads

4-5.3 Monthly Maintenance

1) After long periods of operation, the heads of the Videocorder may become magnetized. This will result in an increase in noise level and may also result in erasure of some portion of the recorded signals. The heads can be degaussed with a conventional head demagnetizer. Should you prefer, the video and sync heads may be removed from the head drum assembly. Remove the four small screws holding the head drum cover on to the head assembly. Note location of Sync Head mounting screw, loosen and with headtool remover (supplied with Videocorder) gently lift head up and away from head drum assembly. To remove video head, line up opening in front of head assembly with video head retaining screw. Similarly, lift video head from assembly. Degauss heads and then install on to the head assembly.

2) A periodic check of the DC readings and waveforms shown in Chapter 5-3 should be made in order to properly evaluate machine performance.

3) The take-up and supply reel tension adjustments as described in chapter 4-4 should be periodically checked.

chapter V / TROUBLESHOOTING AIDS

5-1. GENERAL

1. Difficulties in operating the Videocorder usually can be traced to some simple error or omission in the operation of the Videocorder. If the problem persists, reference to the following list of some typical problems and the remedial action to be taken in each instance should be of some value.

2. A photographic reproduction of the waveforms available at all the module test points is included in this chapter to further assist you with any service problems.

3. Additionally, a voltage chart of the DC voltages available at the Power Supply test points is included.

4. If the trouble persists, the Technical Service Department of the Industrial Products Division of Sony will be glad to provide any assistance to you. A list of the various area offices are included in chapter 6.

5-2. SPECIFIC PROBLEMS:

SYMPTOM	POSSIBLE CAUSE
Equipment does not go on	1. Check AC input to machine. 2. Check that interlock switch on rear panel is closed. 3. Check fuse in rear panel. Replace if blown. If machine will still not come on, proceed with a point-to-point inspection of Power Supply system.
Machine will not pull tape through tape transport system	1. Check that Capstan rotates in PLAY, REC, RWD, or FFWD modes. 2. Check that tape is properly threaded. 3. Make sure that head drum cover panel is closed so that interlock switch is depressed. 4. Check to see that there is sufficient line voltage available by setting Meter Sel. switch on control panel to AC line position.
Head Drum does not rotate	1. If tape runs but the head drum does not rotate, check for correct head motor voltage by setting Meter Sel. switch on control panel to MOTOR position. If reading is not in correct portion of scale refer to Maintenance Chapter 4.
Poor picture quality	1. Check quality of input signal on suitable monitor to insure that source signal is not at fault. 2. Insure that proper video input level is present on Videocorder. Set Meter Sel. switch on control panel to VIDEO LEVEL position and adjust video gain control to proper scale reading. 3. Video head dirty or dusty. Clean as described in Maintenance Chapter 4-5. 4. Video head magnetized. Use head demagnetizer to degauss head. 5. Defective video head. Exchange video head with sync head for immediate determination. 6. Damaged tape. Record video signal on new reel of tape and view reproduced picture. 7. If trouble persists refer to Maintenance Chapter 4-3.

5-3. VOLTAGE CHART AND WAVEFORMS

VOLTAGE CHART

POWER SUPPLY SYSTEM

TEST POINT	READING	TEST POINT	READING
TPA +	250 v DC	TPE +	70 VDC
TPB +	450 v DC	TPF +	24 VDC
TPC +	250 v DC	TPG+, TPGH-	36 VDC
TPD +	70 v DC	TPH+, TPGH-	24 VDC

MOTOR POWER AMPLIFIER PART 2

TPX, TPY	0 v DC 260 v AC , PP/100V AC, RMS

NOTE: Readings taken with a 20,000 ohm/voltmeter. Test points located on rear panel of Videocorder.

MECHANICAL DATA

TAPE TRANSPORT

PLAY MODE

Supply Reel Torque: 250 grams

Take-up Reel Torque: ~~250~~ 250 grams

FAST FORWARD MODE

Supply Reel Tension: 200 grams

REWIND MODE

Take-up Tension: 200 grams

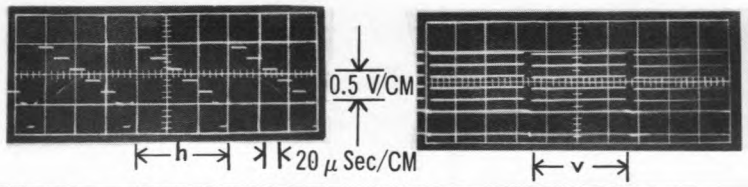
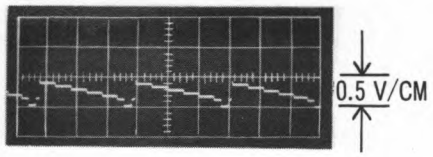
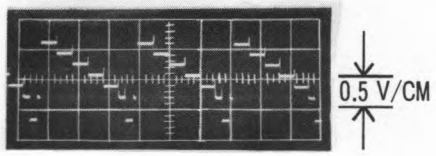
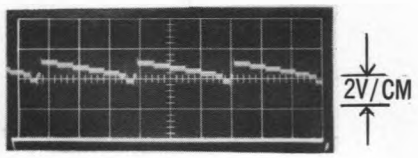
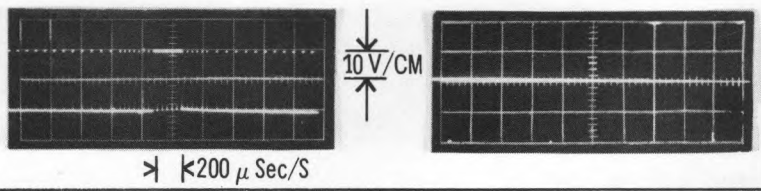
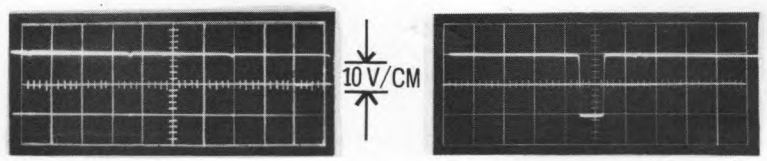
STILL MODE

Supply Reel Torque: 1300 grams

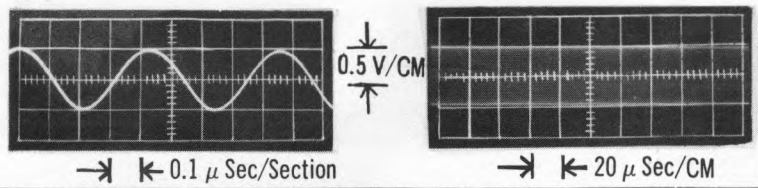
Take-up Reel Torque: ~~1500~~ 1300 grams

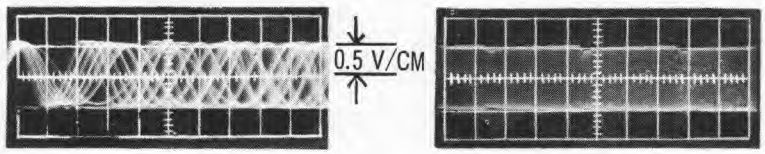
MODULATOR PART 1

FIGURE 5–1

	TEST SIGNAL (Stair Step)		MORE THAN 0.5 VP-P
TP_1	VIDEO INPUT		
TP_2	PRE-EMPHASIZED VIDEO		
TP_3	MODULATING VIDEO		4V DC WITHOUT VIDEO INPUT
TP_4	SEPARATED SYNC		
TP_5	VERTICAL DRIVE PULSE for SERVO		

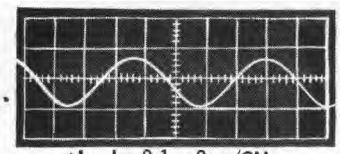
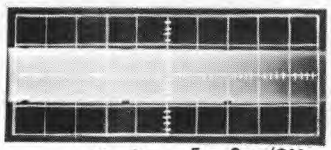
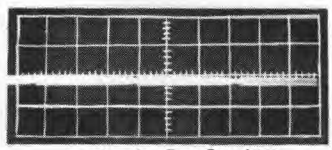
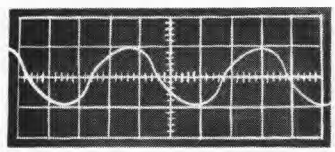
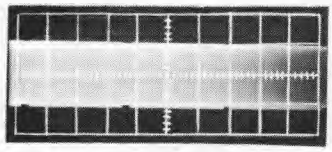
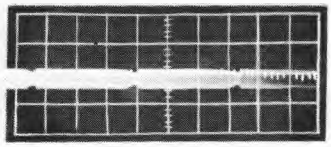
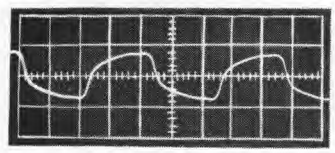
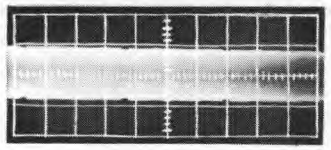
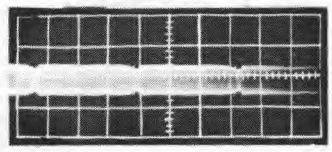
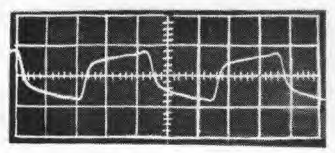
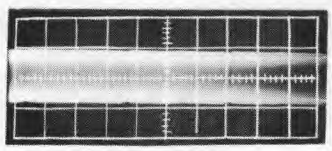
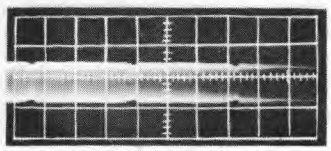
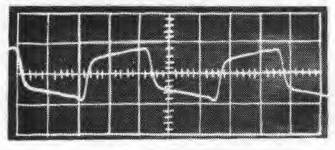
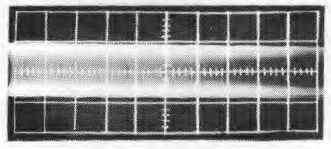
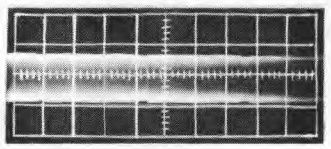
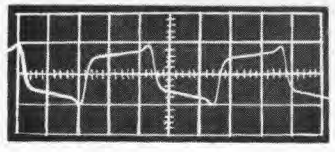
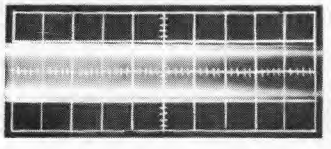
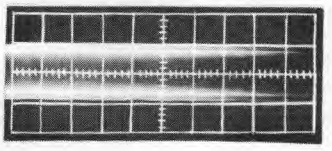
MODULATOR PART 2

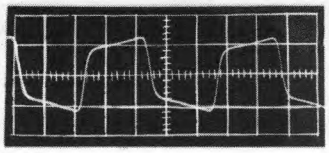
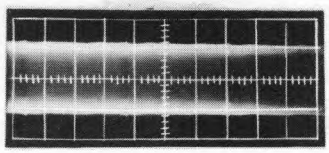
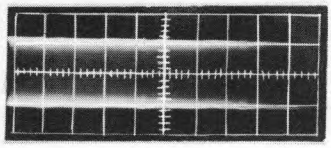
TP_{201}	RF OUT NO MODULATION		1 V p-p Clean Sine Wave

TP_{201}	RF OUT MODULATED		AM Less Than 10%

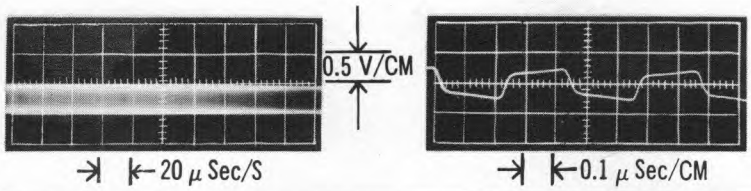
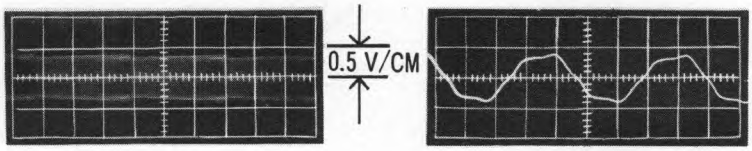
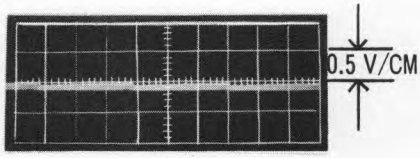
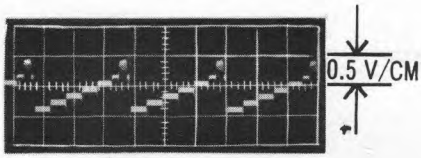
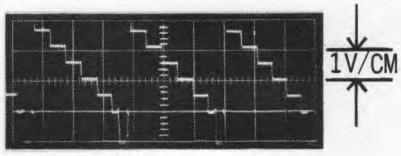
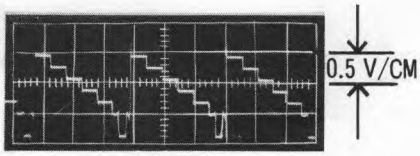
DEMODULATOR PART 1

FIGURE 5–2

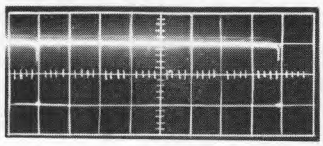
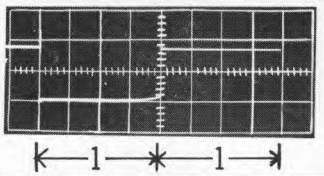
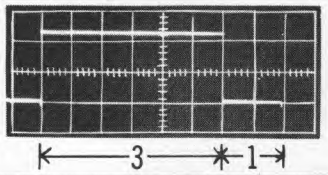
	E–E / RECORD		PLAY
	WITHOUT MODULATION	NORMAL MODULATION	
TP_1			
TP_2			
TP_3			
TP_4			
TP_5			
TP_6			

TP_7			

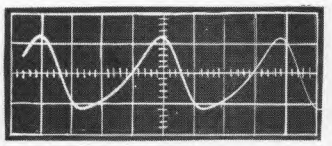
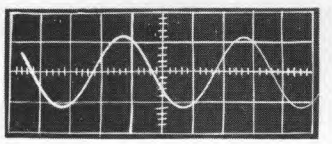
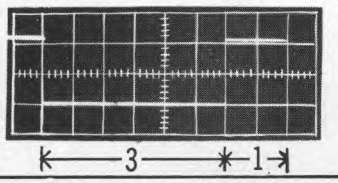
DEMODULATOR PART 2 FIGURE 5–3

TP_1	RF INPUT		MUST BE 0.5 V p-p
TP_2	RF CONVERTED TO AM		
TP_3	DETECTED VIDEO		
TP_4	VIDEO BEFORE DE-EMPHASIS		
TP_5	DE-EMPHASIZED VIDEO		
TP_6 TP_7	VIDEO OUTPUT		Adjust to Required Output Level (maximum) 2 V

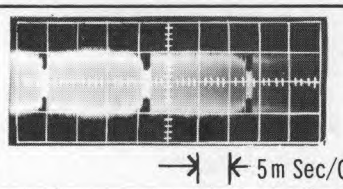
SERVO PART 1 — RECORD / PLAY — FIG. 5–4

TP_1	TRIGGER from MOD in RECORD from Control Track in PLAY		
TP_2	Multivibrator OUT		MUST HAVE 1 to 1 Ratio
$\frac{TP_4}{TP_3}$ in S/N 1051 S/N 1075	Phase Comparator OUT		MUST HAVE 1 to 3 Ratio

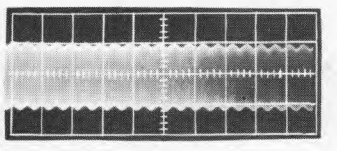
SERVO PART 2 — RECORD / PLAY

TP_1 TP_2	USED TO STOP SERVO ACTION WHEN ADJUST CENTER FREQUENCY OF MAIN OSCILLATOR		
TP_3	Oscillator Out		
TP_4	60 C/S OUT		MUST BE EXACTLY 60 ±0.2 cps When TP_1 and TP_2 are shorted together
TP_5	Control Signal		MUST HAVE 1 to 3 Ratio

PLAYBACK HEAD AMPLIFIER — PLAY — FIG. 5–5

TP_1	OUTPUT		

AUDIO PART 2 — RECORD

TP_1	HEAD CURRENT		Audio Signal: 1 KC –70 DB from MIC INPUT

chapter VI / REPLACEMENT PARTS AND SERVICE

Complete stocks of parts are available from any of the below listed Sony Service Areas. When ordering any replacement parts, please refer to the circuit symbol, description, and stock number listed for each of the mechanical and electrical assemblies for the Sony Videocorder.

The Industrial Products Division of the Sony Corporation of America also maintains complete technical service facilities at each of the listed regional offices. Each of these offices is capable of performing any minor or major services and repairs to the Sony Videocorder or associated equipment.

EASTERN REGIONAL OFFICE	Sony Corporation of America 580 Fifth Avenue New York, New York TEL: (201)-581-0144
CENTRAL REGIONAL OFFICE	Sony Corporation of America 4959 West Belmont Avenue Chicago, Illinois TEL: (312)-283-0712
WESTERN REGIONAL OFFICE	Sony Corporation of America 516 West Florence Avenue Inglewood, California TEL: (213)-678-8911

Note:

1. All values of capacitors are shown in microfarads unless otherwise noted.
2. All values of resistors are shown in ohms and are rated at 1/2 watt unless otherwise noted.
3. A component listed with an asterisk(*) preceding the symbol number is to indicate that the actual in-circuit value utilized of a particular module will vary from listed value according to circuit design.

PARTS LIST

COMPLETE ELECTRONIC ASSEMBLIES AND SUB-ASSEMBLIES

SYMBOL	DESCRIPTION	STOCK NUMBER
	Modulator Part 1	X-3109-50-00
	Modulator Part 2	X-3109-54-00
	Record Amplifier	X-3109-58-00
	Playback Head Amplifier	X-3109-60-00
	Demodulator Part 1	X-3109-63-00
	Demodulator Part 2	X-3109-65-00
	Servo Part 1	X-3109-69-00
	Servo Part 2	X-3109-71-00
	Motor Power Amplifier Part 1	X-3109-73-00
	Motor Power Amplifier Part 2	X-3109-75-00
	Audio Part 1	X-3109-76-00
	Audio Part 2	X-3109-80-00
	Erase Oscillator	X-3109-83-00
	System Control Part 1	X-3109-84-01
	System Control Part 2	X-3109-85-00
	System Control Part 3	X-3109-87-00
	Power Supply Part 1	X-3109-90-00
	Power Supply Part 2	X-3109-91-00
	Power Supply Part 3	X-3109-92-00
	Power Supply Part 4	X-3109-93-00

COMPLETE MECHANICAL ASSEMBLIES AND ASSOCIATED PARTS

SYMBOL	DESCRIPTION	STOCK NUMBER
	Head Drum Assembly	
	Slow Motion Mechanism	3109-01-03
	Fuel Shaft Assembly	
	Tension Servo Assembly	3109-26-00
	Head Assembly	3109-21-01
	Brake Assembly	3109-43-00
	Reel Drive Assembly	0037-0901
	Capstan Motor Assembly	HC-634-A
	Tape Position Indicator Gear Box	3109-48-01
	Tape Position Indicator Driving Shaft	3109-49-01
	Tape Transport Mechanism	3109-31-00
	Supply or Take-up Spindle	3109-11-01
	Supply Tension Arm	3109-26-00
	Take-up Tension Arm	3109-46-00
	Brake Drum	3109-43-00
	Pinch Roller Assembly	3109-31-00
	Capstan Flywheel	
	Slow Motion Idler Wheel	3109-01-03
	Stationary Head Assembly	3109-21-01

ELECTRICAL PARTS FOR TAPE TRANSPORT

SYMBOL	DESCRIPTION	STOCK NUMBER
C1	Capacitor, AC type, dual .5/250VAC and 1.5/250VAC	SB-16112
C2	Capacitor, AC type, dual 10/250V AC	SB-16113
C3	Capacitor, AC type, dual 8/25V AC	SB-16110
C4	Capacitor, AC type, dual 2/250V AC	SB-16111
CR1 to CR5	Diode, 1S122	
H1, H2	Signal Head, video or sync	VS-31-31
H3	Audio Record/Playback Head	
H4	Control Track Head	

ELECTRICAL PARTS FOR TAPE TRANSPORT (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
H5	Audio Erase Head	
H6	Erase Head, full-width	
MT-1	Capstan Motor	
MT-2	Reel Motor	
MT-3	Head Motor	
PL-1, Q1	Automatic Machine Stop Assembly	
R1, R2	Resistor, Variable, Wirewound 330, 25W	
R3	Resistor, Carbon 33	
R4 to R8	Resistor, Carbon 1K	
	Solenoid, Brake/Reel	SB-16114
	Solenoid, Slow	SB-16115
	Solenoid, Pinch-Roller	SB-16117
SW1	Switch, 50/60 cps	MST-21 SN

PARTS FOR CONNECTOR PANEL

SYMBOL	DESCRIPTION	STOCK NUMBER
CN2	Connector, (Monitor)	NK-SID-325
CN3	Connector, Coaxial, Video	M-RDJN-7
C1	Capacitor, Electrolytic, 500/25v	25 RA 500-T6
F1	Fuse, 5 amp	SB-16108
	Fuse Holder	SB-16101
J1	Jack, phono, audio	2C-2
R1	Resistor, 75	
R2, R3	Resistor, 10k, 1w	
R4	Resistor, 600, 1w	
SW1	Switch, Rotary (AIR LINE)	0322P
SW2	Switch, Interlock, Microswitch, 22AC-J3	122D17AN
	Dust Cap, for CN-2 Connector	NK-60A2

PARTS FOR CONTROL PANEL

SYMBOL	DESCRIPTION	STOCK NUMBER
M1	Meter, VU	
	Meter Rectifier	SB 16103
PL1, PL2	Pilot Bulb, 6.3v @ 2.2a	1076S
	Pilot Bulb Socket	SB-13358
R1	Resistor, Variable, 75ohm (Video Level)	AXRD 750A
R2	Resistor, Variable, 10k (Audio Level)	AXRD 103C
SW1	Switch, Power	ST-22N
SW2	Switch, Audio Monitor, Slide	SB-16102
SW3	Switch, Meter Select	221-A
SW4	Switch, STOP, Microswitch	V3-609-J
SW5	Switch, SLOW	V3-609-J
SW6	Switch, STILL	V3-609-J
SW7	Switch, RECORD	V3-609-J
SW8	Switch, REWIND	V3-609-J
SW9	Switch, FAST FWD.	V3-609-J
SW10	Switch, PLAY	V3-609-J
SW11	Switch, RECORD	V3-609-J
SW12	Switch, AUDIO DUB	V3-609-J

PARTS FOR AUDIO PART 1

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C2	Capacitor, electrolytic, 100/6V	
C3, C7	Capacitor, electrolytic, 100/15V	
C4, C6, C9, C12, C18, C20, C24	Capacitor, electrolytic, 10/10V	
C5	Capacitor, electrolytic, 100/10V	
C8, C21	Capacitor, electrolytic, 50/50V	
C10	Capacitor, mylar, 0.1/100V	
C11, C17, C23	Capacitor, electrolytic, 100/25V	
C13	Capacitor, electrolytic, 1/10V	
C14	Capacitor, mylar, .01/100V	
C15	Capacitor, electrolytic, 500/6V	
C16, C26	Capacitor, electrolytic, 100/50V	
C19	Capacitor, electrolytic, 500/15V	
C22	Capacitor, electrolytic, 5/15V	
C25	Capacitor, mylar, .05/100V	
C27, C29	Capacitor, mylar, .5/50V	
C28	Capacitor, electrolytic, 10/25V	
Q1	Transistor, 2SB377	
Q2, Q3, Q6	Transistor, 2SB382	
Q4, Q7	Transistor, 2SC15	
Q5	Transistor, 2SD64	
RY1	Relay	FBV 153J-71/101
RY2	Relay	FBV 153I-71/1
R1	Resistor, carbon, 56K	
R2, R17, R28	Resistor, carbon, 100K	
R3, R20, R42	Resistor, carbon, 10K	
R4	Resistor, carbon, 470	
R5	Resistor, carbon, 22K	
R6, R9, R41	Resistor, carbon, 2.2K	
R7, R34	Resistor, carbon, 33K	
R8	Resistor, carbon, 39K	
R10	Resistor, carbon, 220	
R11, R25	Resistor, carbon, 4.7K	
R12, R14	Resistor, variable, 10K	
R15	Resistor, carbon, 18K	
R16	Resistor, carbon, 27K	
R18, R21, R32, R33, R40	Resistor, carbon, 1K	
R19, R24, R37, R44, R47	Resistor, carbon, 100	
R22	Resistor, carbon, 3.3K	
R23, R35, R49	Resistor, carbon, 47K	
R26	Resistor, carbon, 10	
R27, R45	Resistor, carbon, 1.2K	
R29	Resistor, carbon, 82K	
R30	Resistor, carbon, 1.5K	
R31	Resistor, variable, 200	
R36, R48	Resistor, carbon, 2.7K	
R38	Resistor, carbon, 12K	
R39	Resistor, variable, 5K	
R43	Resistor, carbon, 68K	
R46	Resistor, carbon, 33	
T1	Transformer, audio input, 10K:10K	SB-15178
T2	Transformer, audio input, 600CT:10K	THS-2
T3	Transformer, audio output, 2.7K:600:40	SB-14629

PARTS FOR AUDIO PART 2

SYMBOL	DESCRIPTION	STOCK NUMBER
C1	Capacitor, electrolytic, 200/15V	
C2, C7	Capacitor, electrolytic, 10/10V	
C4, C6	Capacitor, electrolytic, 100/10V	

PARTS FOR AUDIO PART 2 (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
C5	Capacitor, mylar, .03/100V	
C8, C16, C18	Capacitor, electrolytic, 100/25V	
C9	Capacitor, mica, 1000mmfd/300V	
C10	Capacitor, electrolytic, 10/50V	
C11, C12, C14	Capacitor, mylar, .01/100V	
C13	Capacitor, paper, .05/250V	
C15	Capacitor, trimmer, 200mmfd.	
C17	Capacitor, electrolytic, 50/25V	
C19	Capacitor, mylar, .002/100V	
C20	Capacitor, mica, 5000mmfd/300V	
CR1, CR2	Diode, SD-102	
L1	Coil, 4.3 mhy.	SB-16138
CH201	Coil, choke, 5mhy.	SB-15556
Q1	Transistor, 2SB377	
Q2	Transistor, 2SB382	
Q3, Q4	Transistor, 2SC15	
R1	Resistor, carbon, 15K	
R2	Resistor, carbon, 120	
R3, R12	Resistor, carbon, 22K	
R4	Resistor, variable, 5K	
R5, R7	Resistor, carbon, 3.3K	
R8	Resistor, carbon, 47	
R9	Resistor, carbon, 10K	
R10	Resistor, variable, 10K	
R11	Resistor, carbon, 18K	
*R13, R14	Resistor, carbon, 33K-47K	
R15, R16	Resistor, carbon, 27K	
R17	Resistor, carbon, 10	
R18, R20	Resistor, carbon, 100	
R19	Resistor, carbon, 390	
RY1	Relay	FBV 153I-71/1
RY2	Relay	FBV 153J-71/101
T201	Transformer, audio input	SB-16139

PARTS FOR DEMODULATOR PART 1

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C2, C6, C7, C10, C11, C14, C15, C18, C19, C22, C23, C26	Capacitor, ceramic, .01/50V	
C3	Capacitor, ceramic, 200mmfd/50V	
C4, C8, C12, C16, C20, C24, C27	Capacitor, ceramic, .02/50V	
C5, C9, C13, C17, C21, C25	Capacitor, ceramic, 1000mmfd/50V	
C28	Capacitor, ceramic, .05/50V	
L1 to L5	Coil, 15mhy	
L6	Coil, 10mhy	
CR1 to CR24	Diode, SD-17	
Q1 to Q18	Transistor, 2SC15	
R1	Resistor, carbon, 75	
*R2, R14, R25, R36, R47, R58	Resistor, 47K-82K	
R3, R15, R26, R37, R48, R59	Resistor, carbon, 4.7K	
R4	Resistor, carbon, 1.5K	
R5, R17, R28	Resistor, carbon, 150	

PARTS FOR DEMODULATOR PART 1 (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
R6, R18, R29, R40, R51, R62	Resistor, carbon, 1K, 1W	
R7, R19, R30, R41, R52, R63	Resistor, carbon, 33	
R8, R13, R20, R24, R31, R35, R42, R46, R53, R57, R64, R69	Resistor, carbon, 1K	
R9, R21, R32, R43, R54, R65	Resistor, carbon, 27K	
R10, R66	Resistor, variable, 100	
R11, R22, R33, R44, R55	Resistor, carbon, 33K	
R12, R23, R34, R45, R56, R68	Resistor, carbon, 10K	
R16, R27, R38, R49, R60	Resistor, carbon, 2.2K	
R39, R50, R61	Resistor, carbon, 120	
R67	Resistor, carbon, 12K	
R70	Resistor, carbon, 560	

PARTS FOR DEMODULATOR PART 2

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C6, C9	Capacitor, ceramic, .05/50V	
C2 to C5	Capacitor, ceramic, .01/50V	
C7	Capacitor, ceramic trimmer, 45mmfd/500V	
C8, C10	Capacitor, electrolytic, 10/15V	
C11	Capacitor, electrolytic, 50/25V	
C12	Capacitor, ceramic, 10mmfd/50V	
C13, C14	Capacitor, electrolytic, 30/15V	
C15, C19, C22, C27	Capacitor, electrolytic, 100/25V	
C16	Capacitor, ceramic, 300mmfd/50V	
C17	Capacitor, electrolytic, 100/15V	
C18, C20	Capacitor, electrolytic, 50/15V	
C21	Capacitor, ceramic, 390mmfd/50V	
C23 to C26	Capacitor, electrolytic, 200/15V	
C28, C29	Capacitor, electrolytic, 20/15V	
C30, C31	Capacitor, electrolytic, 5/25V	
CR1, CR2	Diode, SD-17	
Q1 to Q10, Q13	Transistor, 2SC15	
Q11, Q12	Transistor, 2SC140	
R1, R11, R17, R18	Resistor, carbon, 330	
R2	Resistor, variable, 100	
R3, R15, R30, R34	Resistor, carbon, 4.7K	
R4, R31	Resistor, carbon, 33K	
R5, R28	Resistor, variable, 500	
R6	Resistor, carbon, 82	
R7, R13	Resistor, carbon, 820	
R8	Resistor, carbon, 5.6K	
R9, R49, R55, R60	Resistor, carbon, 27K	
R10	Resistor, carbon, 120	
R14, R50, R56, R64	Resistor, carbon, 8.2K	
R16	Resistor, carbon, 15K	
R19, R26, R38, R58	Resistor, carbon, 100	
R20, R21	Resistor, carbon, 2.7K	
R22, R33	Resistor, carbon, 1.5K	
R33	Resistor, carbon, 47K	
R24, R25	Resistor, carbon, 2.2K	
R27	Resistor, carbon, 680	
R32, R36, R41	Resistor, carbon, 150	

PARTS FOR DEMODULATOR PART 2 (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
R35	Resistor, carbon, 22K	
R37, R42, R52, R63	Resistor, carbon, 1K	
R39, R40	Resistor, carbon, 1.2K	
R43	Resistor, carbon, 220	
R44, R45, R61, R62	Resistor, carbon, 12K	
R46, R47	Resistor, variable, 1K	
R48	Resistor, variable, 10K	
R51, R57	Resistor, carbon, 10K	
R53	Resistor, carbon, 22	
R54	Resistor, carbon, 470, 1W	
R59	Resistor, carbon, 270, 1W	

PARTS FOR ERASE OSCILLATOR

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C2, C4, C5	Capacitor, ceramic, .01/500V	
C3	Capacitor, mylar, 0.1/100V	
C6	Capacitor, mica, .01/300V	
R1	Resistor, carbon, 39	
R2	Resistor, carbon, 22K	
R3	Resistor, carbon, 82K, 2W	
R4	Resistor, wirewound, 300, 5W	
R5	Resistor, carbon, 18K, 1W	
R6, R7	Resistor, carbon, 4.7K	
R8, R9	Resistor, carbon, 15K	
R10, R11	Resistor, carbon, 150K	
T1	Transformer	SB-16107
V1, V2	Vacuum Tube, 15CW5	

PARTS FOR MODULATOR PART 1

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C12	Capacitor, ceramic, 200mmfd/50V	
C2, C11, C13	Capacitor, electrolytic, 50/6V	
C3	Capacitor, electrolytic, 50/15V	
C4	Capacitor, tantalum, 3.3/15V	
C5, C9	Capacitor, electrolytic, 100/25V	
C6	Capacitor, electrolytic, 20/15V	
C7, C10, C15	Capacitor, ceramic, .02/50V	
C8	Capacitor, ceramic, 50mmfd/50V	
C14	Capacitor, tantalum, 1.0/15V	
C16, C17, C19	Capacitor, ceramic, .01/50V	
C18, C20	Capacitor, electrolytic, 5/25V	
C21	Capacitor, electrolytic, 50/25V	
CR1, CR2	Diode, SD-17	
CR3, CR4	Diode, RD-6A	
Q1 to Q10, Q12	Transistor, 2SC15	
Q11	Transistor, 2SB382	
R1, R17, R32	Resistor, carbon, 1.8K	
R2	Resistor, carbon, 470	
R3, R27, R36	Resistor, carbon, 47K	
R4	Resistor, carbon, 6.8K	
R5, R9, R11, R15, R24, R31	Resistor, carbon, 1K	
R6, R10	Resistor, carbon, 150	
R7, R42	Resistor, carbon, 120	

PARTS FOR MODULATOR PART 1 (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
R8, R22, R29	Resistor, carbon, 1.5K	
R13	Resistor, carbon, 270K	
R14	Resistor, carbon, 12K	
R16, R19	Resistor, carbon, 680	
R18	Resistor, carbon, 3.9K	
R20	Resistor, variable, 500	
R21, R25	Resistor, carbon, 820	
R23	Resistor, variable, 2K	
R26, R28, R38, R41	Resistor, carbon, 4.7K	
R30	Resistor, carbon, 180	
*R33	Resistor, carbon, 220K-1meg	
R34, R40	Resistor, carbon, 18K	
R35	Resistor, carbon, 15K	
R37	Resistor, carbon, 27K	
R39	Resistor, carbon, 2.7K	

PARTS FOR MODULATOR PART 2

SYMBOL	DESCRIPTION	STOCK NUMBER
C201	Capacitor, ceramic, 500mmfd/500V	
C202	Capacitor, electrolytic, 20/15V	
C203, C210	Capacitor, ceramic, 100mmfd/50V	
C204, C208, C209, C211	Capacitor, ceramic, .01/50V	
C212, C305, C205, C213	Capacitor, ceramic, .02/50V	
C206	Capacitor, ceramic, 10mmfd/50V	
C207	Capacitor, ceramic, 20mmfd/50V	
C301, C304	Capacitor, ceramic, 50mmfd/50V	
C302	Capacitor, trimmer, 25mmfd	
C303	Capacitor, trimmer, 45mmfd	
CR201, CR202	Diode, vari/cap, MA301	
CR203	Diode, zenor, RD9A	
L201, L202	Coil, 1mhy	
L203 to L205, L302	Coil, 10mhy	
L301	Coil, .79mhy	
L303	Coil, 20mhy	
L304	Coil, .5mhy	
Q201 to Q301	Transistor, 2SC15	
R201, R206, R210, R216, R224	Resistor, carbon, 1K	
R202, R208	Resistor, carbon, 120	
R203	Resistor, variable, 30K	
R204	Resistor, carbon, 27K	
R205	Resistor, carbon, 4.7K	
R207	Resistor, carbon, 33	
R209, R225, R304	Resistor, carbon, 100	
R211	Resistor, carbon, 15K	
R212	Resistor, carbon, 10K	
R213	Resistor, variable, 500	
R214	Resistor, carbon, 47K	
R215, R222	Resistor, carbon, 5.6K	
R217	Resistor, carbon, 150	
R218	Resistor, carbon, 22K	
R219	Resistor, carbon, 12K	
R220	Resistor, carbon, 680	
R221	Resistor, carbon, 33K	
R223	Resistor, carbon, 22	
R301	Resistor, carbon, 330	
R302	Resistor, carbon, 6.8K	
R303	Resistor, carbon, 1.8K	

PARTS FOR PLAYBACK HEAD AMPLIFIER

SYMBOL	DESCRIPTION	STOCK NUMBER
C0001, C0002, C0004, C0005, C0007, C010, C012	Capacitor, ceramic, .01/50V	
C003	Capacitor, electrolytic, 100/50V	
C006, C104, C205	Capacitor, ceramic, .01/500V	
C008, C011, C206	Capacitor, ceramic, 50mmfd/50V	
C009	Capacitor, ceramic, 20mmfd/50V	
C013, C102, C103, C105, C203, C204	Capacitor, ceramic, .05/50V	
C101	Capacitor, ceramic, .001/50V	
C106	Capacitor, ceramic, 100mmfd/50V	
C201	Capacitor, ceramic, 10mmfd/50V	
C202	Capacitor, ceramic, 50mmfd/500V	
CR001 to CR005	Diode, SD-17	
L001, L101	Choke Coil, 20 mhy	
Q001 to Q202	Transistor, 2SC15	
RY001	Relay	RP7641G8
R001	Resistor, carbon, 220	
R002	Resistor, carbon, 3.1K	
R003	Resistor, wirewound, 1.2K, 5W	
R004, R018, R209	Resistor, carbon, 330	
*R005	Resistor, carbon, 33K	
R006, R015	Resistor, carbon, 10K	
R007, R112	Resistor, carbon, 560	
R008, R113, R213	Resistor, carbon, 120	
R009	Resistor, variable, 50K	
R010	Resistor, carbon, 1K, 1W	
R011	Resistor, carbon, 82	
R012, R016, R109	Resistor, carbon, 1K	
R013	Resistor, carbon, 27K	
R014, R107, R207	Resistor, carbon, 68K	
R017	Resistor, carbon, 22	
R101, R201	Resistor, carbon, 5.1	
R102, R202	Resistor, carbon, 1.5K	
R103, R104, R203, R204	Resistor, carbon, 68	
R105, R205	Resistor, carbon, 39K	
R106, R206	Resistor, carbon, 33K	
R108, R111, R208, R212	Resistor, carbon, 15K	
R110, R211	Resistor, carbon, 47K	
R210	Resistor, carbon, 680	
V101, V201	Vacuum tube, 6DJ8	

PARTS FOR MOTOR POWER AMPLIFIER PART 1

SYMBOL	DESCRIPTION	STOCK NUMBER
C1	Capacitors, mylar, 0.2/100V	
C2	Capacitor, polystyrene, 500mmfd/125V	
C3	Capacitor, electrolytic, 5/300V	
C4	Capacitor, electrolytic, 10/350V	
C5	Capacitor, electrolytic, 10/450V	
C6	Capacitor, polystyrene, 250mmfd/125V	
C7	Capacitor, mylar, 0.2/250V	
C8, C9	Capacitor, mylar, 0.5/250V	
R1	Resistor, variable, 100K	
R2	Resistor, carbon, 470K	
R3	Resistor, carbon, 15K	
R4	Resistor, carbon, 1.2K	
R5	Resistor, carbon, 56K	

PARTS FOR MOTOR POWER AMPLIFIER PART 1 (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
R6	Resistor, carbon, 220K	
R7	Resistor, carbon, 820K	
R8	Resistor, carbon, 22K	
R9, R12	Resistor, carbon, 22K, 1W	
R10	Resistor, carbon, 1meg	
R11	Resistor, carbon, 6.8K	
T1	Transformer, input, 600:100K	SB-15594
V1	Vacuum tube, 6AN8	

PARTS FOR MOTOR POWER AMPLIFIER PART 2

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C2	Capacitor, electrolytic, 40/150V	
C3, C4	Capacitor, electrolytic, 20/300V	
L1	Choke coil	SB-15598
R1, R2	Resistor, carbon, 10K, 1W	
R3, R4	Resistor, variable, 5K	
R5, R6	Resistor, carbon, 100K	
R7, R8	Resistor, carbon, 1K	
R9, R10	Resistor, carbon, 2.7K, 2W	
R11, R12	Resistor, carbon, 390, 1W	
V1, V2	Vacuum tube, 6DQ5	

PARTS FOR POWER SUPPLY CHASSIS

SYMBOL	DESCRIPTION	STOCK NUMBER
C001, C002	Capacitor, dual electrolytic, 1000/50V	FS35-105
C003, C008	Capacitor, dual electrolytic, 100/350V	FS35-94
C004, C005, C006 C007	Capacitor, electrolytic, 200/350V	FSD35-105
C021, C022, C023	Capacitor, electrolytic, 250/150V	FSD25-76
L1	Choke coil, .15hy @ 1 amp	SB-15597
L2	Choke coil, 2 hy @ 0.1 amp	SB-15589
L3	Choke coil, 1 hy @ 0.2 amp	SB-15588
L4	Choke coil, 1 hy @ 0.1 amp	SB-15587
R001	Resistor, 3.3K, 1W	
R002	Resistor, 4.7K, 1W	
R003	Resistor, 56K, 2W	
R004, R005	Resistor, 68K, 2W	
R006	Resistor, 100K, 1W	
T001	Transformer, power	SB-15586

PARTS FOR POWER SUPPLY PART 1

SYMBOL	DESCRIPTION	STOCK NUMBER
C101	Capacitor, paper, 0.1/400V	
CR101 to CR104	Diode rectifier, 1S161	
CR105	Diode rectifier, 1S120	

PARTS FOR POWER SUPPLY PART 2

SYMBOL	DESCRIPTION	STOCK NUMBER
C201	Capacitor, ceramic, .01/50V	
C202	Capacitor, electrolytic, 30/25V	
CR201	Diode, RD6A	
CR202	Diode, RD9A	
Q201	Transistor, 2SC42	
Q202	Transistor, 2SC140	
Q203, Q204	Transistor, 2SC15	
R201	Resistor, wirewound, 3, 5W	
R202	Resistor, carbon, 3.9K	
R203 to R206	Resistor, carbon, 4.7K	
R207	Resistor, carbon, 680,	
R208	Resistor, variable, 200	
R209	Resistor, carbon, 390,	

PARTS FOR POWER SUPPLY PART 3

SYMBOL	DESCRIPTION	STOCK NUMBER
C301, C302	Capacitor, electrolytic, 40/150V	
CR301 to CR304	Diode, 1S124	
CR305, CR306	Diode, 1S122	
R301, R302	Resistor, wirewound, 5, 5W	

PARTS FOR POWER SUPPLY PART 4

SYMBOL	DESCRIPTION	STOCK NUMBER
C401	Capacitor, paper, 0.1/600V	
CR401 to CR406	Diode, 1S124	
R401	Resistor, wirewound, 10, 5W	

PARTS FOR RECORD AMPLIFIER

SYMBOL	DESCRIPTION	STOCK NUMBER
C101, C104, C105, C110, C111, C201, C204, C205, C210, C211	Capacitor, ceramic, .01/50V	
C102, C202	Capacitor, ceramic, 50mmfd/50V	
C103, C106, C107, C206, C203, C207	Capacitor, ceramic, .02/50V	
C108, C109, C208, C209	Capacitor, ceramic, .002/50V	
CR101, CR201	Diode, SD-17	
L101, L201	Choke coil, 300mhy	
Q101 to Q205	Transistor, 2SC15	
R001	Resistor, carbon, 330	
R101, R201	Resistor, variable, 200	
R102, R202	Resistor, carbon, 47K	
R103, R109, R112, R209, R203, R212	Resistor, carbon, 4.7K	
R104, R204	Resistor, carbon, 1.8K	

PARTS FOR RECORD AMPLIFIER (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
R105, R116, R205, R216	Resistor, carbon, 150	
R106, R121, R206, R221	Resistor, carbon, 1K	
R107, R207	Resistor, carbon, 100	
*R108, R111, R208, R211	Resistor, carbon, 22K-47K	
R110, R113, R122, R123, R210, R213, R222, R223	Resistor, carbon, 220	
R117, R217	Resistor, carbon, 22K	
R118, R218	Resistor, carbon, 10K	
R119, R219	Resistor, carbon, 1.5K	
R120, R220	Resistor, variable, 20K	

PARTS FOR SERVO PART 1

SYMBOL	DESCRIPTION	STOCK NUMBER
C1	Capacitor, electrolytic, 200/25V	
C2, C14	Capacitor, ceramic, .003/50V	
C3	Capacitor, mylar film, .2/	
C4, C7	Capacitor, electrolytic, 20/25V	
C5, C6, C12	Capacitor, electrolytic, 100/6V	
C8	Capacitor, electrolytic, 100/25V	
C9, C13	Capacitor, electrolytic, 5/15V	
C10	Capacitor, ceramic, .01/50V	
C11	Capacitor, electrolytic, 5/25V	
CR1	Diode, 1T22G	
CR2	Diode, SD101	
Q1 to Q5, Q7	Transistor, 2SC15	
Q6	Transistor, 2SB382	
R1, R21	Resistor, carbon, 33	
R2	Resistor, carbon, 56K	
R3, R9, R11, R15	Resistor, carbon, 4.7K	
R4	Resistor, carbon, 39K	
R5	Resistor, variable, 50K	
R6	Resistor, carbon, 18K	
R7	Resistor, carbon, 470	
R8, R14, R18	Resistor, carbon, 47K	
R10, R23, R24, R26, R29, R30	Resistor, carbon, 10K	
R12	Resistor, carbon, 2.2K	
R13, R20	Resistor, carbon, 330	
R16	Resistor, carbon, 150K	
R17	Resistor, carbon, 1 meg	
R19, R28	Resistor, carbon, 3.3K	
R22	Resistor, carbon, 220K	
R25	Resistor, carbon, 100	
R27	Resistor, carbon, 1K	

PARTS FOR SERVO PART 2

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C10, C16	Capacitor, electrolytic, 20/15V	
C2	Capacitor, mylar film, .1/	
C3	Capacitor, mylar film, .075/	
*C4	Capacitor, mylar, .03-.002/100V	
C5, C11	Capacitor, mylar film, .047/50V	

PARTS FOR SERVO PART 2 (Continued)

SYMBOL	DESCRIPTION	STOCK NUMBER
C6 to C8	Capacitor, mylar, 1/50V	
C9	Capacitor, electrolytic, 200/25V	
C12	Capacitor, mylar film, .075/	
*C13	Capacitor, mylar, .01/	
C14, C15	Capacitor, mylar film, .2/	
C17	Capacitor, electrolytic, .20/25V	
C18, C19	Capacitor, electrolytic, 100/25V	
C20, C21	Capacitor, electrolytic, 5/25V	
C22	Capacitor, electrolytic, 50/25V	
CR1 to CR3	Diode, SD101	
CR4, CR5	Diode, SD102	
CR6	Diode, IT22G	
L1, L2	Coil	SB 15572
Q1 to Q6	Transistor, 2SC15	
RY1, RY2	Relay	FBV 156G-71/1
R1, R16	Resistor, carbon, 33	
*R2	Resistor, carbon, 5.6K	
R3	Resistor, variab le, 5K	
R6	Resistor, carbon, 2.7K	
R7, R17	Resistor, carbon, 100K	
R8, R35	Resistor, variable, 30K	
R9, R10, R21	Resistor, carbon, 47K	
R11, R34	Resistor, carbon, 56K	
R12	Resistor, carbon, 82	
R13, R22, R25, R31	Resistor, carbon, 10K	
R14	Resistor, carbon, 18K	
R15, R19, R33	Resistor, carbon, 4.7K	
R18, R24	Resistor, carbon, 15K	
R20, R28	Resistor, carbon, 1.5K	
*R23	Resistor, carbon, 220K	
R26	Resistor, carbon, 560	
R27	Resistor, carbon, 680	
R29	Resistor, carbon, 82K	
R30, R32	Resistor, carbon, 6.8K	

PARTS FOR SYSTEM CONTROL PART 1

SYMBOL	DESCRIPTION	STOCK NUMBER
C1 to C11	Capacitor, paper, .22/600V	MH-6P22
CR1 to CR25	Diode, 1S121	
CR26	Diode, 1S122	
RY1 to RY11	Relay	SB 16130

PARTS FOR SYSTEM CONTROL PART 2

SYMBOL	DESCRIPTION	STOCK NUMBER
C1, C3	Capacitor, electrolytic, 100/25V	
C2	Capacitor, electrolytic, 50/25V	
C4 to C14	Capacitor, paper, .22/600V	MH-6P22
C15	Capacitor, electrolytic, 500/25V	
C16	Capacitor, mylar, .1/100V	
CR1	Diode, RD9A	
CR2 to CR6	Diode, 1S121	
Q1, Q2, Q4	Transistor, 2SC15	
Q3	Transistor, 2SC140	
RY1 to RY3	Relay	SB-16130
RY4	Relay	FBV 156A-71/1

PARTS FOR SYSTEM CONTROL PART 3

SYMBOL	DESCRIPTION	STOCK NUMBER
C1	Capacitor, paper, .1/400V	MH-6P1
C2	Capacitor, electrolytic, 200/150V	
CR1 to CR4	Diode, 1S124	
R1	Resistor, wirewound, 5.6, 10W	
R2	Resistor, carbon, 68K, 1W	

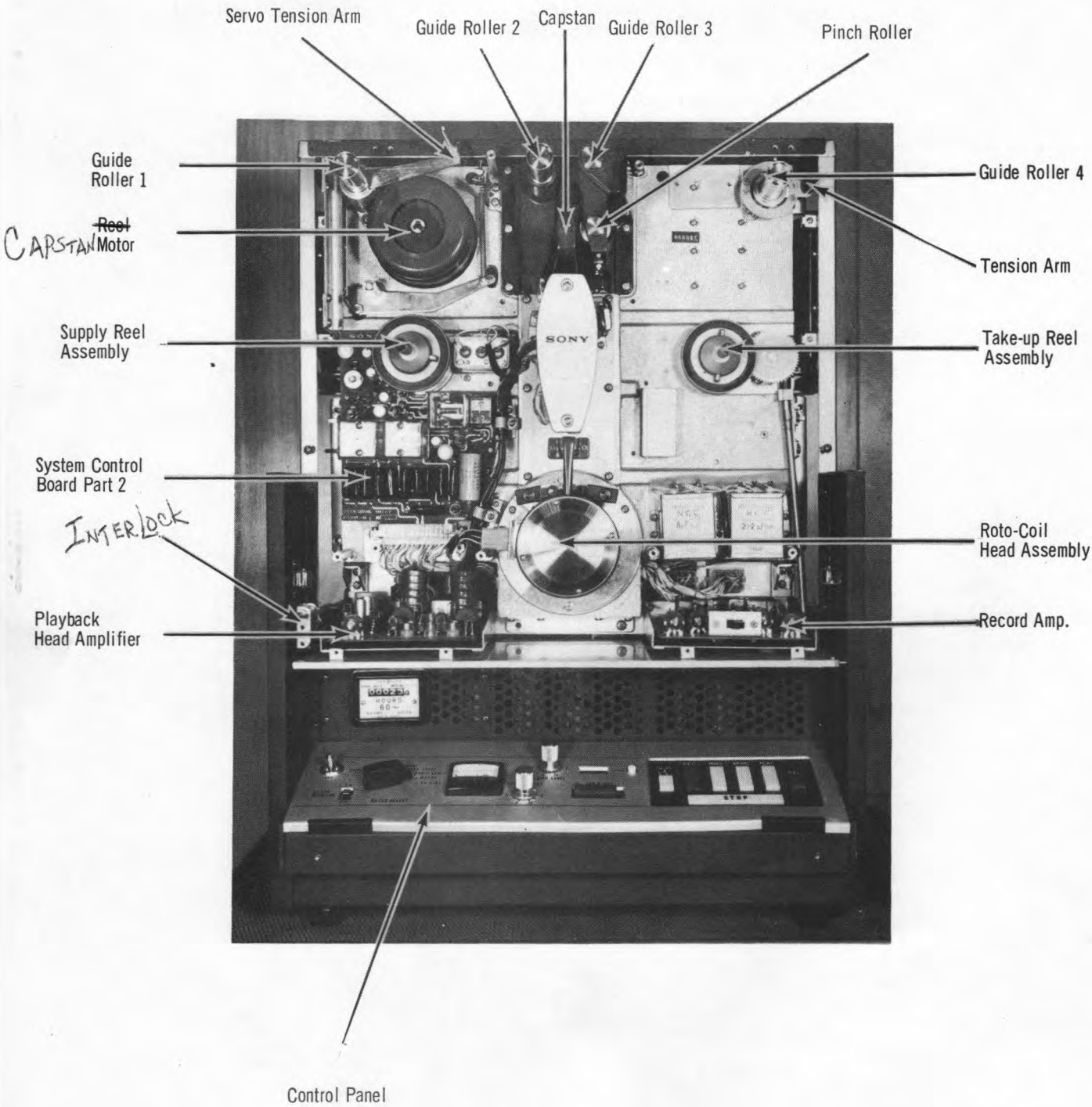


Figure 7-1. Front View of Videocorder With Panels Removed

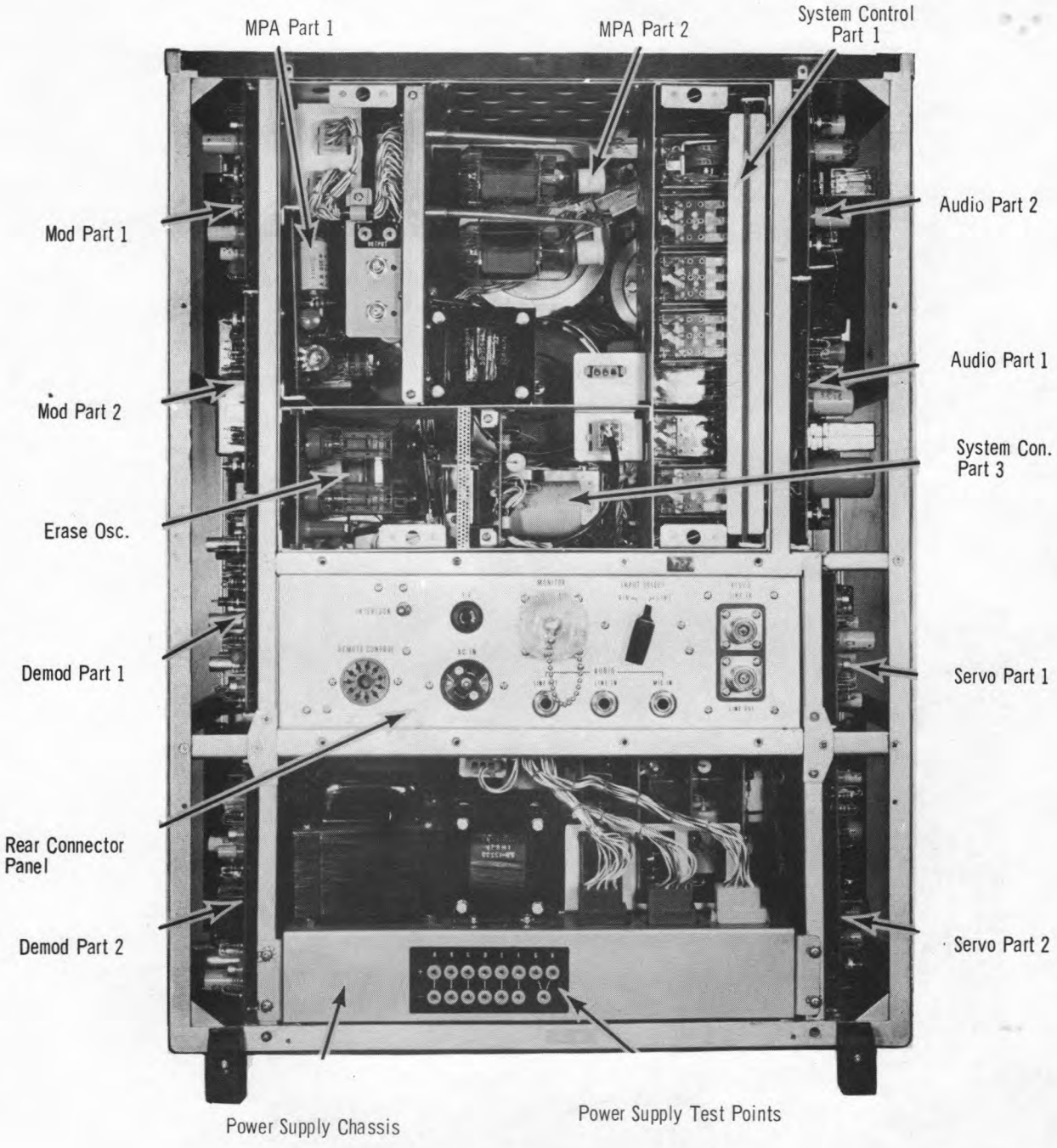


Figure 7-2. Rear View of Videocorder With Panels Removed

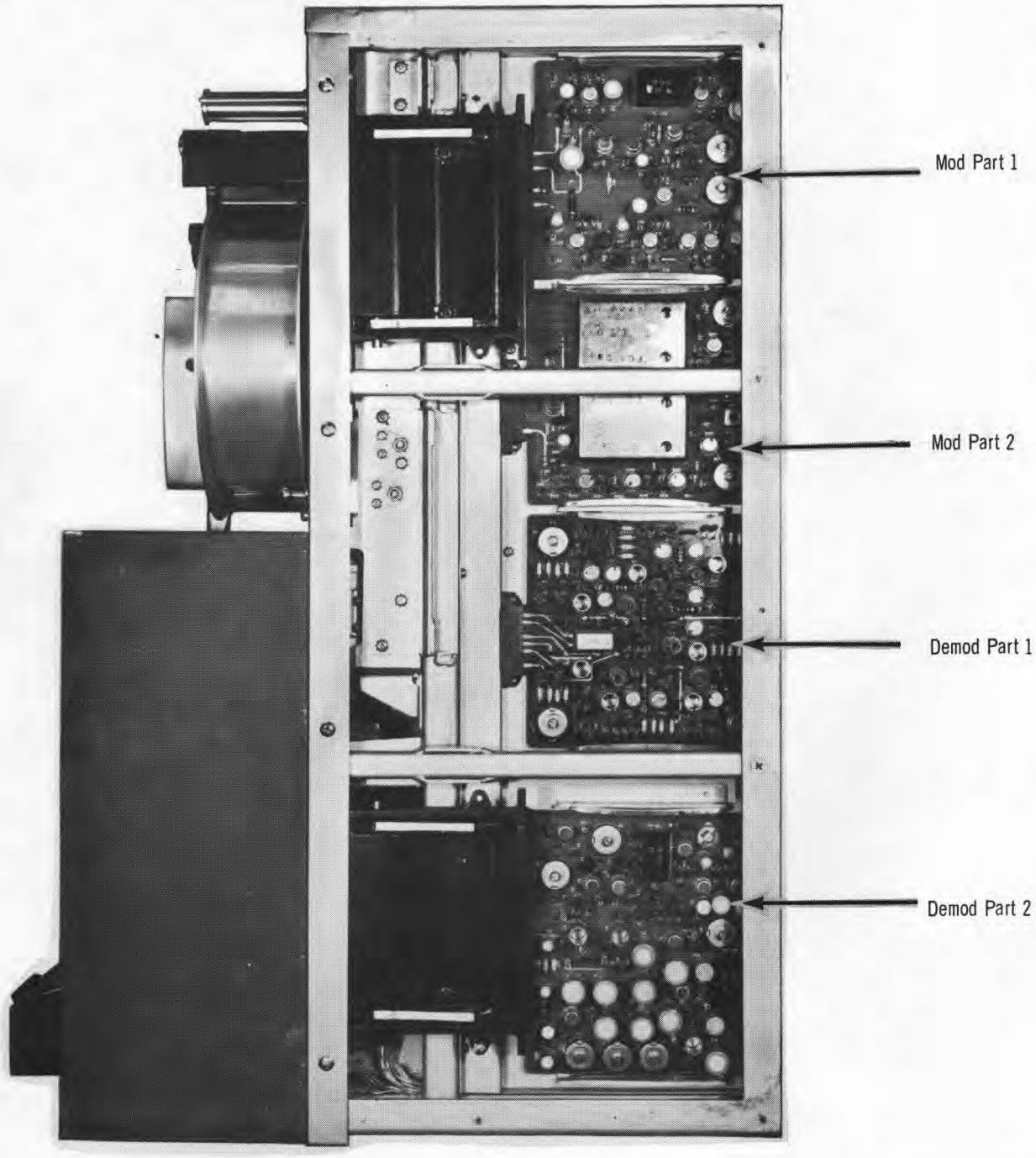


Figure 7-3. Right-Hand Side View of Videocorder

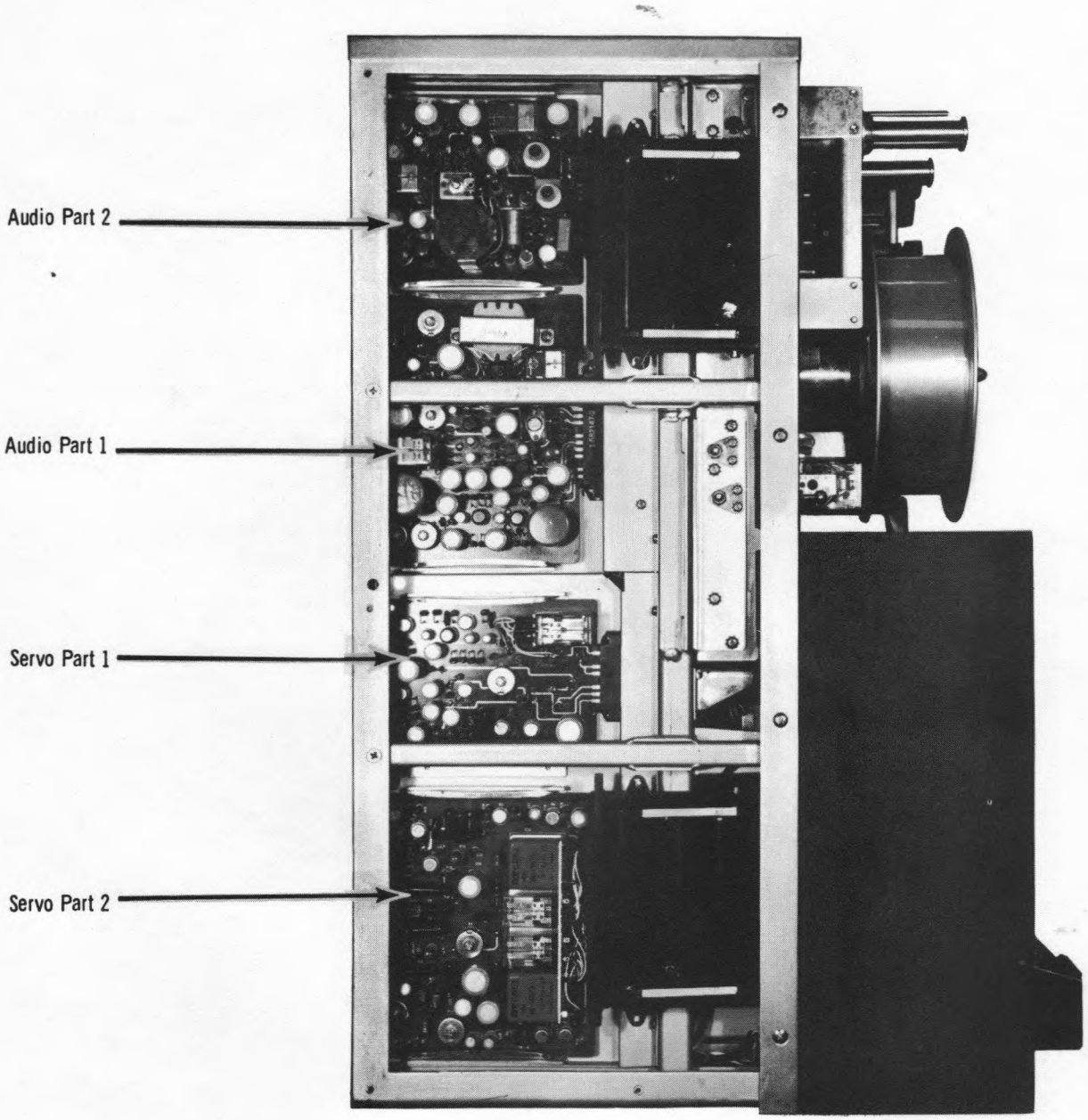


Figure 7-4. Left-Hand Side View of Videocorder

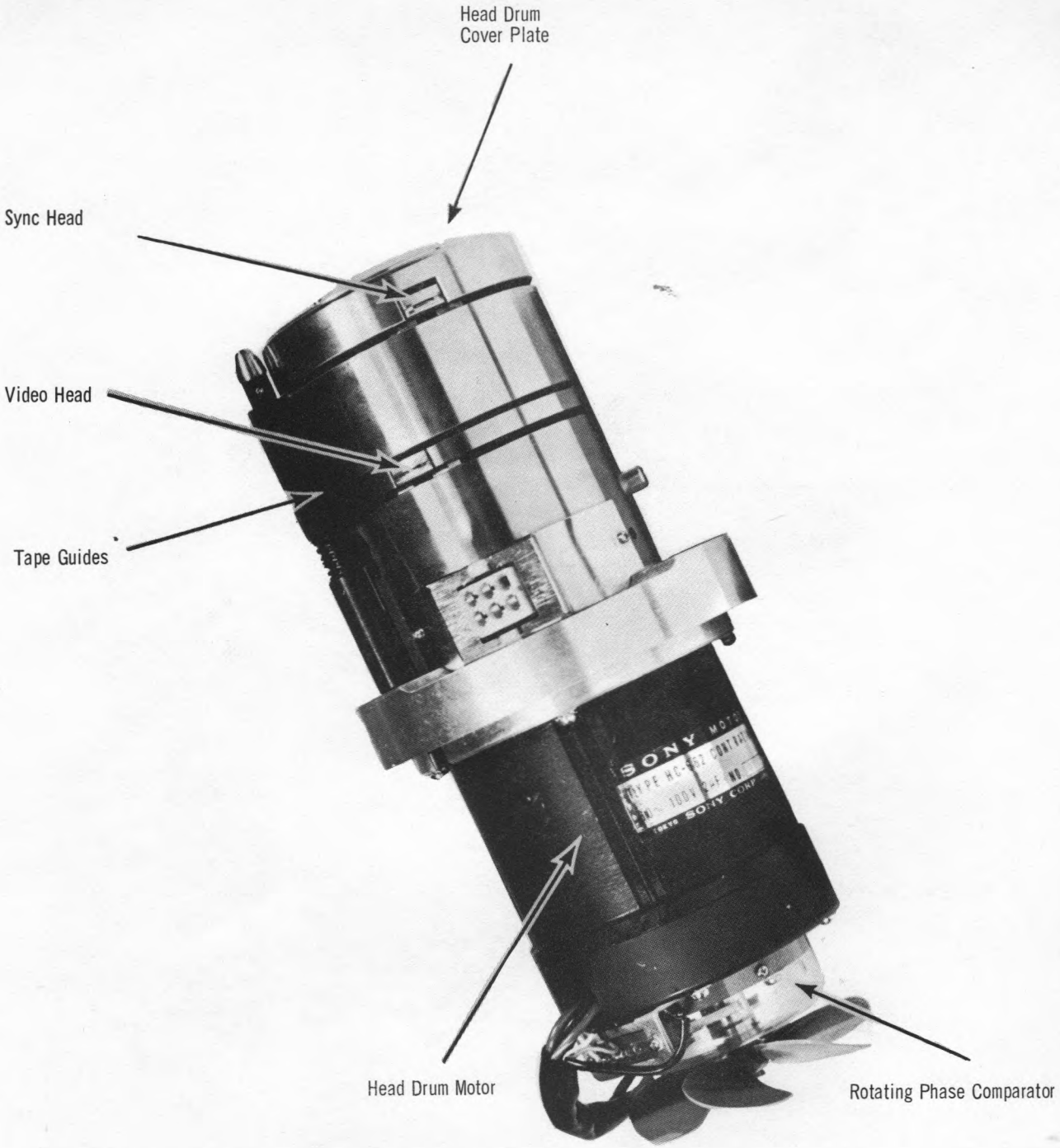
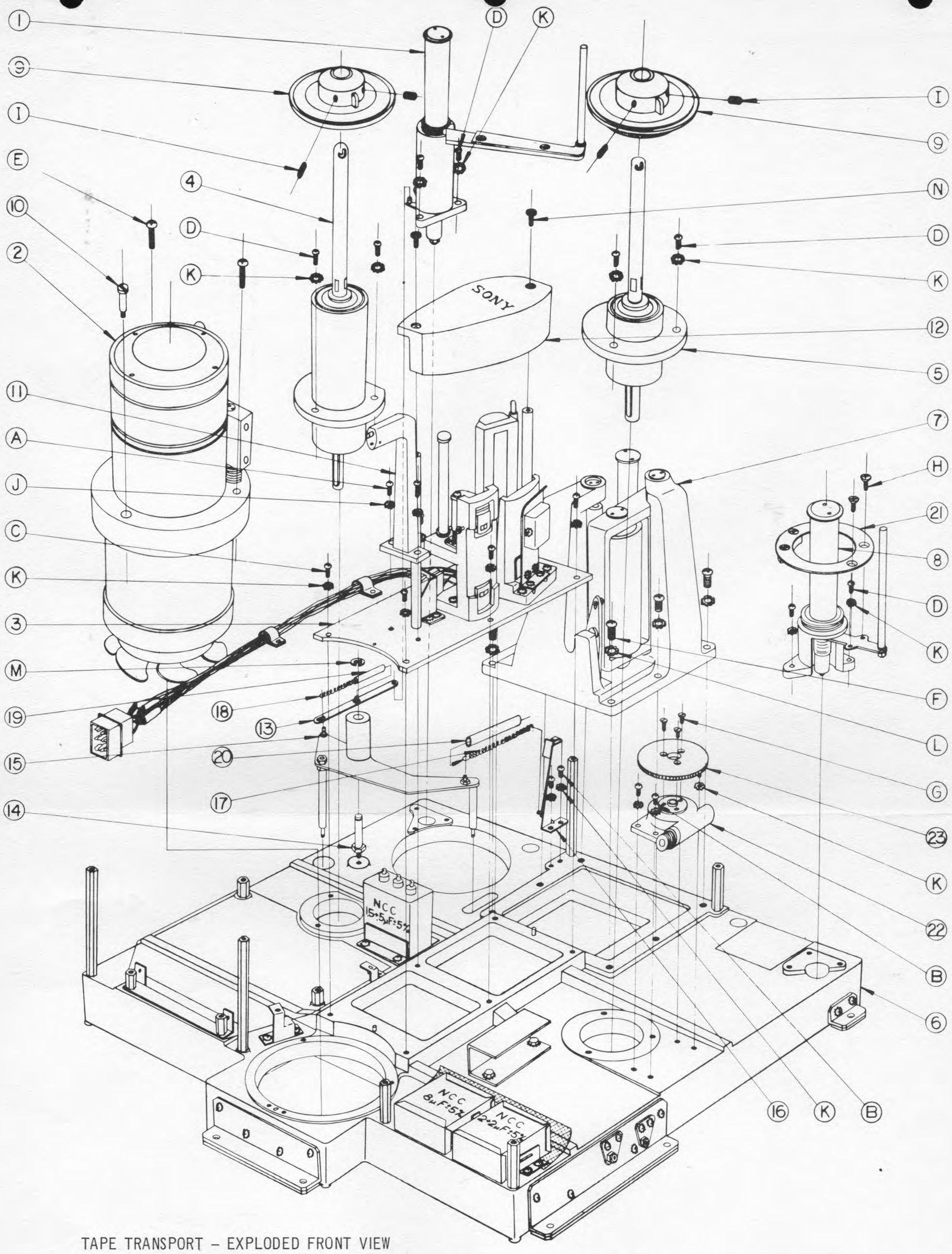


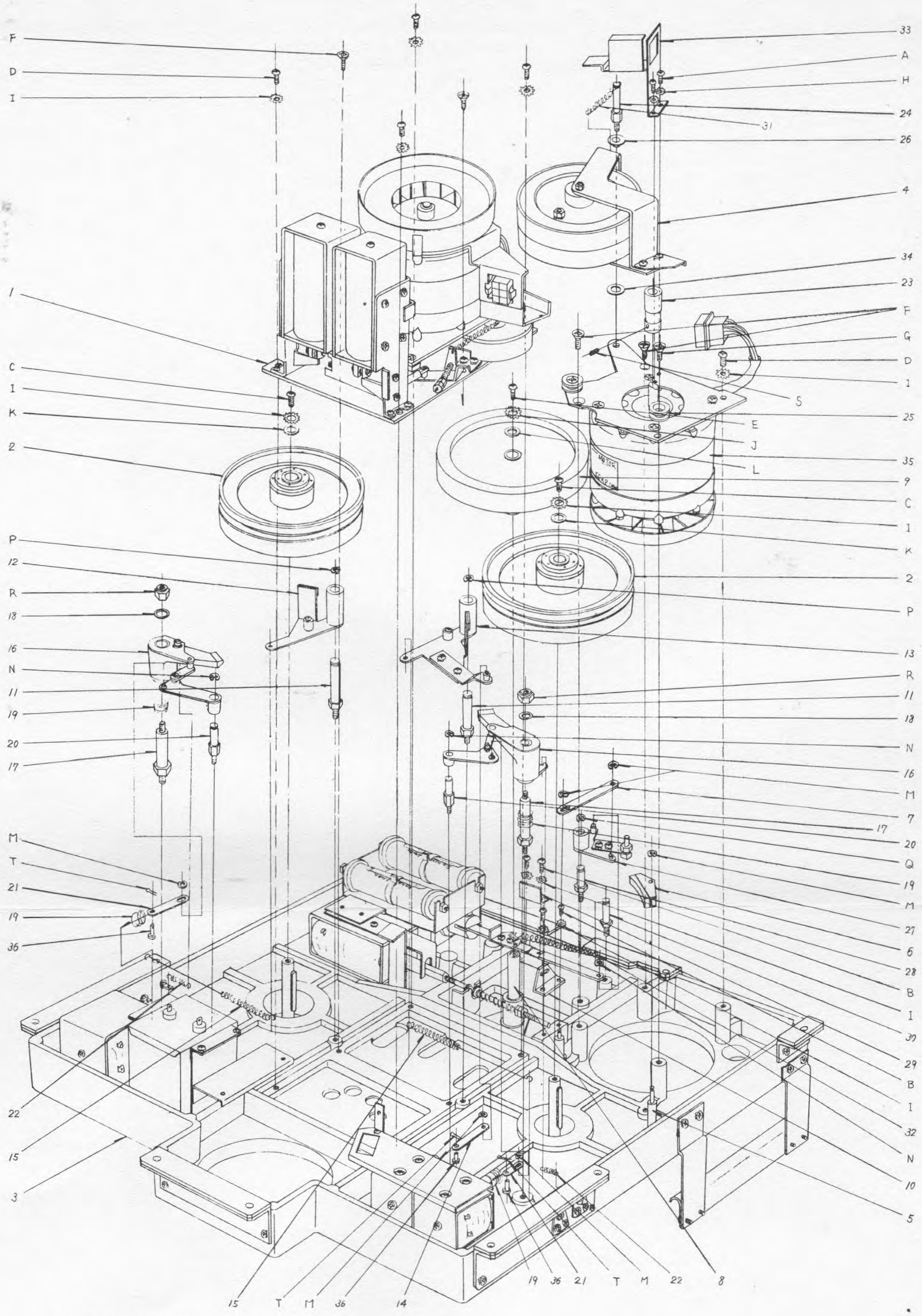
Figure 7-5. Roto-Coil Assembly



TAPE TRANSPORT – EXPLODED FRONT VIEW

PARTS LIST FOR EXPLODED DRAWING OF TAPE TRANSPORT

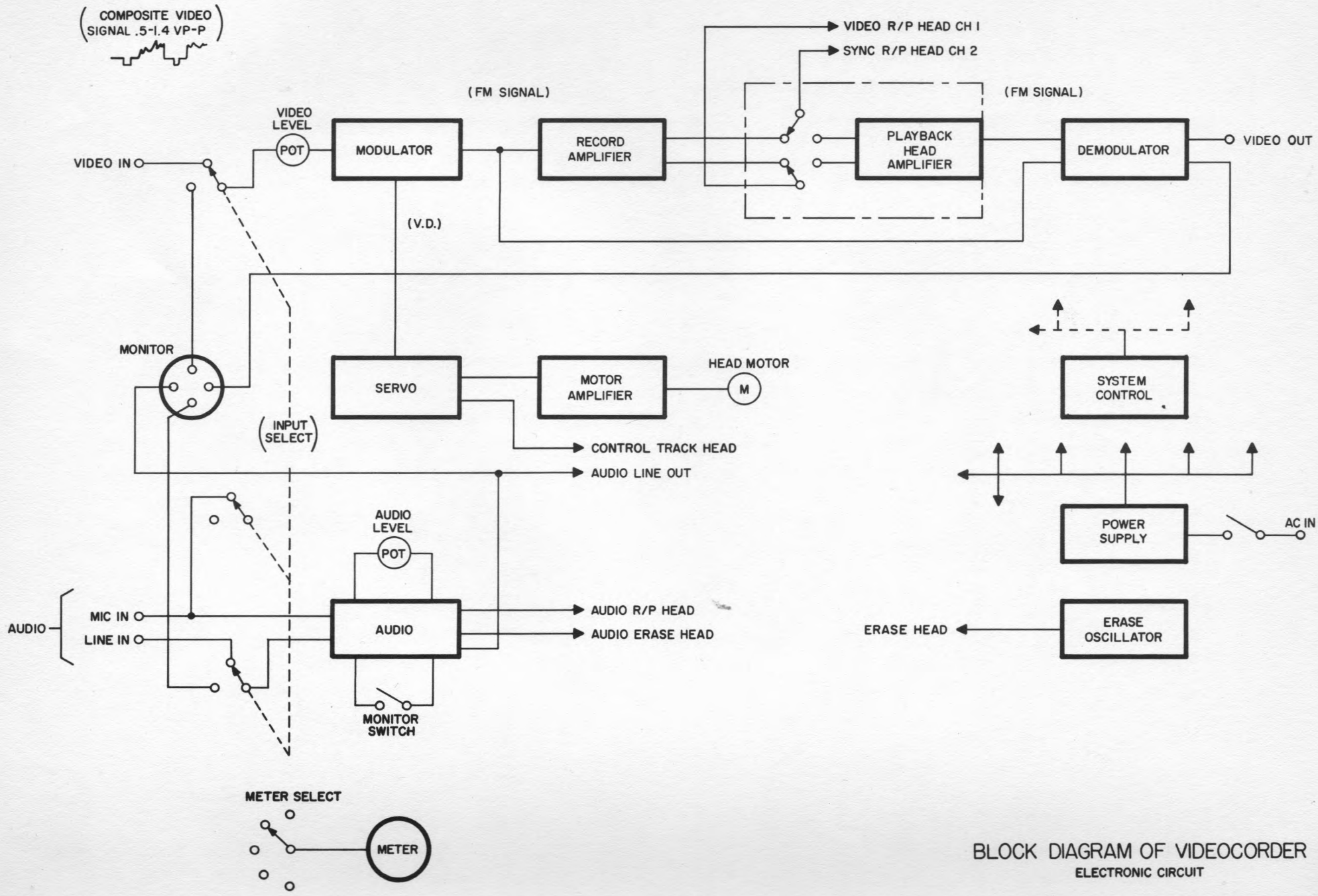
Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
1	X-3109-26-00	SUPPLY TENSION ARM ASS'Y.	12	3109-156-00	STATIONARY HEAD COVER
2	X-3109-28-01	ROTARY HEAD ASS'Y.	13	3109-179-00	TENSION ARM LINK
3	X-3109-21-00	STATIONARY HEADS ASS'Y.	14	3109-181-00	TENSION BRAKE LEVER SHAFT
4	X-3109-09-01	REEL SHAFT ASS'Y. "A"	15	3109-182-00	TENSION BRAKE LEVER
5	X-3109-10-01	REEL SHAFT ASS'Y. "B"	16	3109-189-01	TENSION BRAKE SPRING HANGER
6	X-3109-02-01	BASE PLATE ASS'Y.	17	3109-193-01	TENSION BRAKE SPRING
7	X-3109-31-00	TAPE DRIVE ASS'Y.	18	3109-194-01	TENSION ARM SPRING
8	X-3109-46-00	TAKE-UP TENSION ARM ASS'Y.	19	3109-195-00	TENSION ARM DUMPER TUBE
9	3109-048-01	REEL REST	20	3109-195-01	TENSION BRAKE DUMPER TUBE
10	3109-129-00	ROTARY HEAD ASS'Y. ALIGNMENT SCREW	21	3109-433-01	TENSION LEVER BALANCER
			22	X-3109-48-01	TAPE TIMER GEAR ASS'Y.
11	3109-131-00	DRUM STOPPER	23		TAPE TIMER DRIVE GEAR



TAPE TRANSPORT, EXPLODED REAR VIEW

PARTS LIST TAPE TRANSPORT

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
1	X-3109-13-01	REEL DRIVE ASS'Y.	19	3109-382-00	STOP BRAKE ARM SPRING
2	X-3109-43-00	REEL BRAKE DRUM ASS'Y.	20	3109-385-00	STOP BRAKE LEVER SHAFT
3	X-3109-02-01	BASE PLATE ASS'Y.	21	3109-387-01	STOP BRAKE LEVER LINK
4	X-3109-01-03	SLOW MOTION ASS'Y.	22	3109-390-01	STOP BRAKE SPRING
5	3109-183-00	TENSION BRAKE SHAFT	23	3109-396-$\frac{15}{28}$	CAPSTAN MOTOR PULLEY
6	3109-184-00	TENSION BRAKE SHOE	24	3109-399-00	CAPSTAN IDLER SPRING HANGER
7	3109-188-00	TENSION BRAKE LINK	25	3109-401-00	CAPSTAN IDLER SPACER "A"
8	3109-213-03	CAPSTAN SHAFT	26	3109-402-00	CAPSTAN IDLER SPACER "B"
9	3109-214-02	CAPSTAN FLY WHEEL	27	3109-403-00	CAPSTAN IDLER ARM "A"
10	3109-246-00	PLUNGER LINK GUIDE	28	3109-405-00	CAPSTAN IDLER ARM SHAFT
11	3109-345-00	FRICTION BRAKE SHAFT	29	3109-408-00	PLUNGER LINK STOPPER
12	3109-347-01	FRICTION BRAKE ARM "A"	30	3109-410-00	CAPSTAN IDLER RELEASE SPRING HANGER
13	3109-348-02	FRICTION BRAKE ARM "B"	31	3109-418-02	CAPSTAN IDLER SPRING
14	3109-353-01	FRICTION BRAKE LINK	32	3109-419-02	CAPSTAN IDLER RELEASE SPRING
15	3109-356-01	FRICTION BRAKE SPRING	33	3109-420-00	CAPSTAN MOTOR CONNECTOR HOLDER
16	3109-377-$\frac{04}{05}$	STOP BRAKE ARM	34	3109-421-00	CAPSTAN IDLER SPACER "C"
17	3109-378-00	STOP BRAKE SHAFT	35	X-3109-07-01	CAPSTAN MOTOR ASS'Y.
18	3109-379-00	STOP BRAKE ARM WASHER	36	SB-16114	PLUNGER PIN



BLOCK DIAGRAM OF VIDEOCORDER

ELECTRONIC CIRCUIT

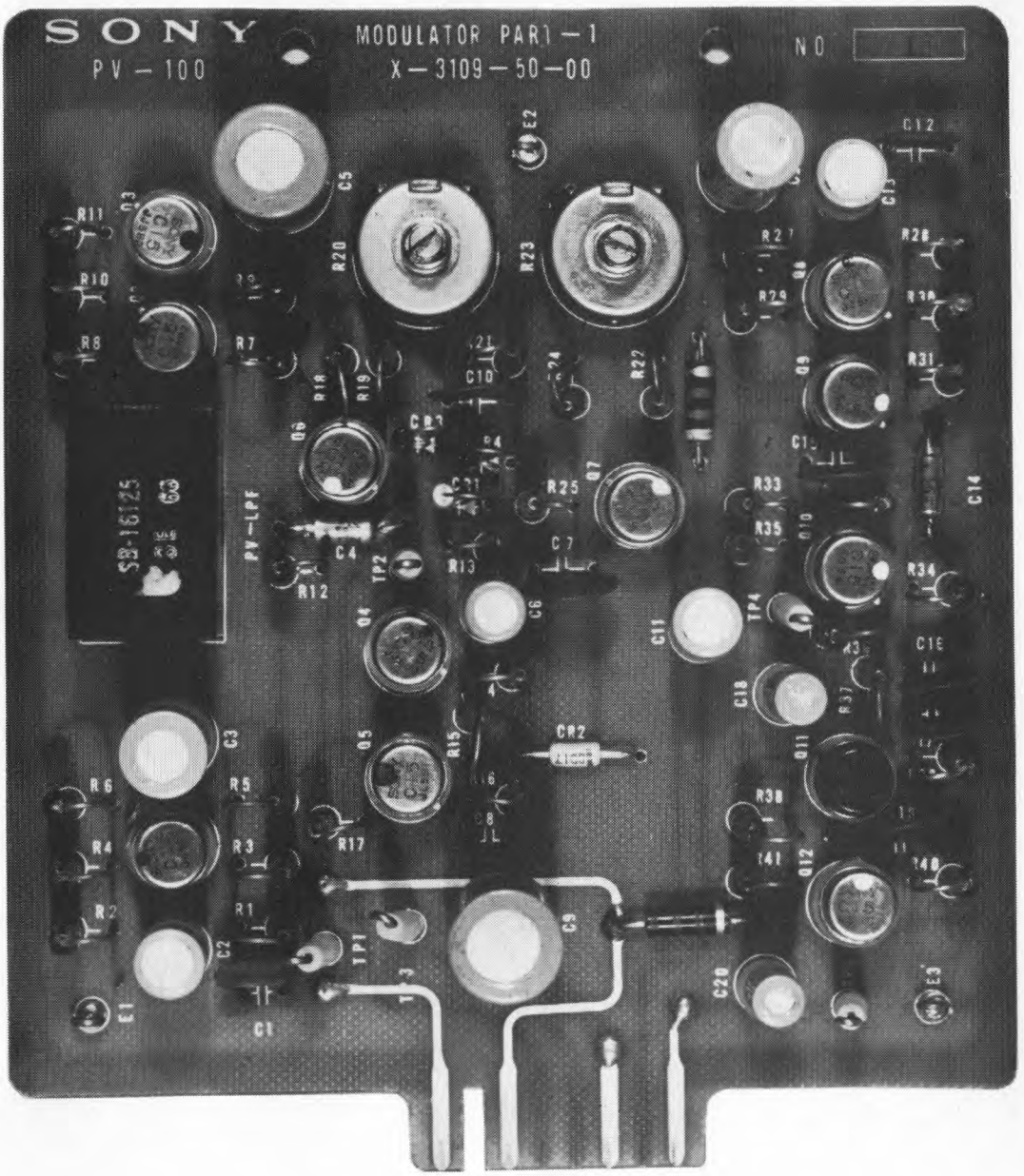
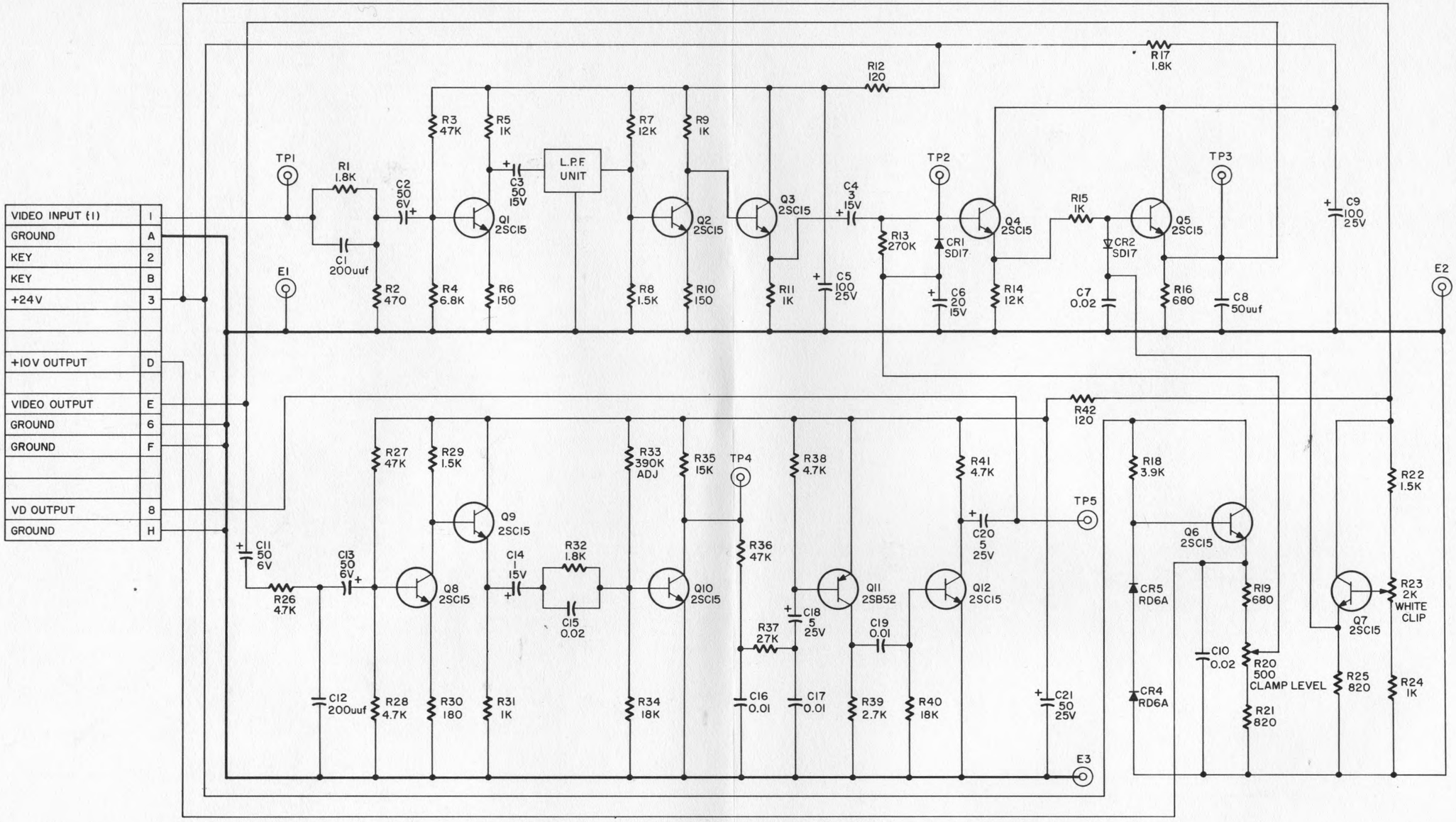


Figure 7-8. Photograph, Modulator Part 1



MODULATOR PART I
X-3109-50-00

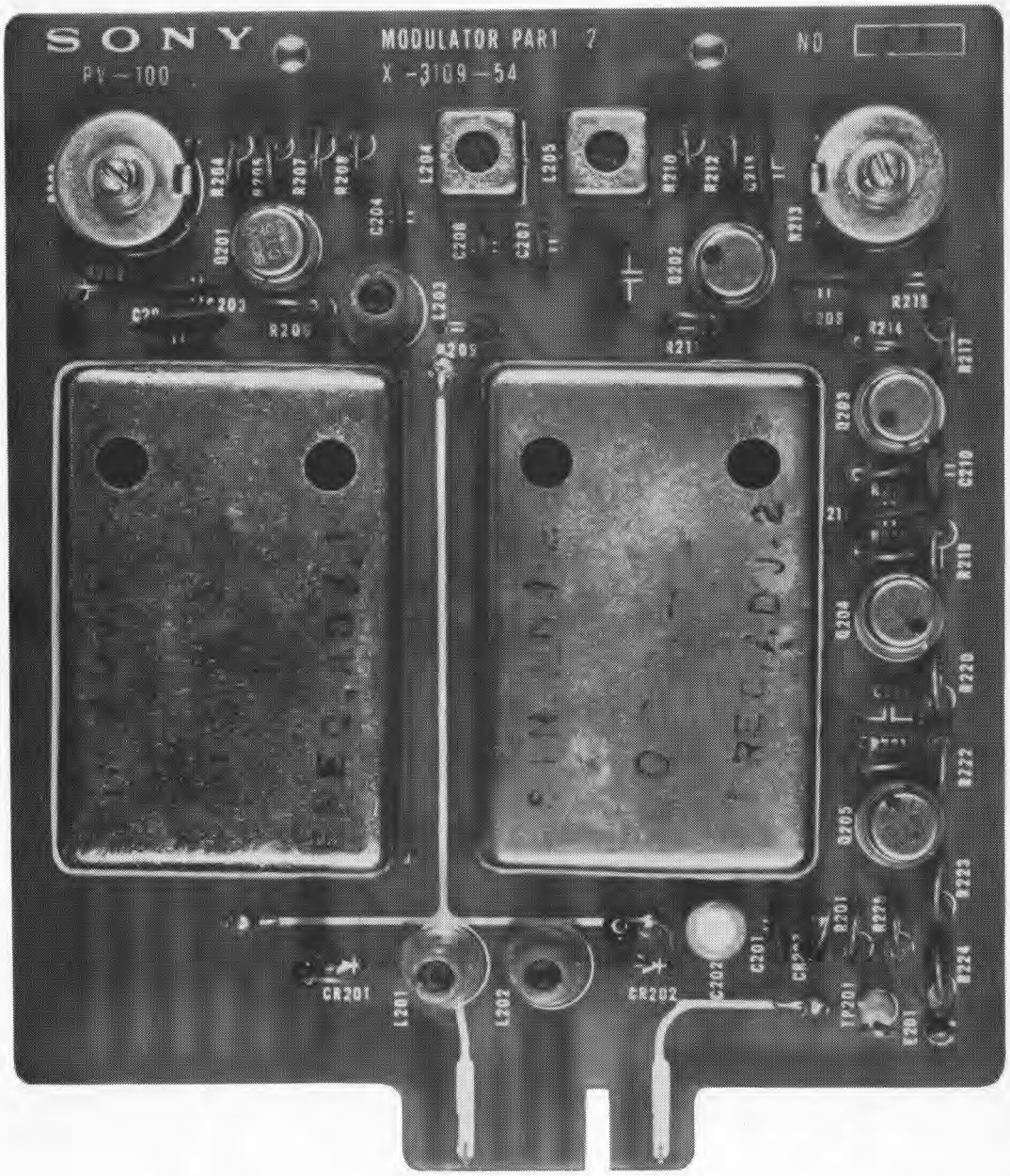


Figure 7-9. Photograph, Modulator Part 2

+10V INPUT	2
VIDEO INPUT	C
KEY	6
KEY	F
+24V	G
RF OUT PUT	8
GROUND	A
GROUND	D
GROUND	E
GROUND	H

MOD OSC UNIT-(1)

MOD OSC UNIT-(2)

+10V
R304 100
L201 1uh
L302 10uh
L301 0.79uh
R302 6.8K
C304 50uuf
C301 50uuf
TO VARI-CAP
Q301 2SC15
C305 0.01
R301 330
L303 20uh
R303 1.8K
C302 25uuf FREQ ADJ-1
CR201 MA301
C303 45uuf SIN ADJ-1
L304 0.5uh
GROUND
OSC OUT
GROUND

R209 100
+10V
L202 1uh
TO VARI-CAP
CR202 MA301
R201 1K
CR203 RD9A
C201 500 uuf
C202 20 15V
GROUND
OSC OUT
GROUND

L203 10uh
R203 30K BIAS ADJ
R206 1K
R204 27K
C204 0.01
C205 0.02
Q201 2SC15
C203 100 uuf
R205 4.7K
R207 33
R202 120
R208 120

R225 100
R216 1K
R221 33K
R18 22K
R214 47K
R211 15K
TP201
Q205 2SC15
Q204 2SC15
C211 0.01
Q203 2SC15
Q202 2SC15
C208 0.01
L205 10uh
L204 10uh
C213 0.02
R223 22
C212 0.01
C209 0.01
R224 1K
R222 5.6K
R219 12K
R217 150
C210 100 uuf
R215 5.6K
R213 500
RF GAIN
R212 10K
R210 1K
C207 20uuf
C206 10uuf
E201

ADD #1

MODULATOR PART 2
X-3109-54-00

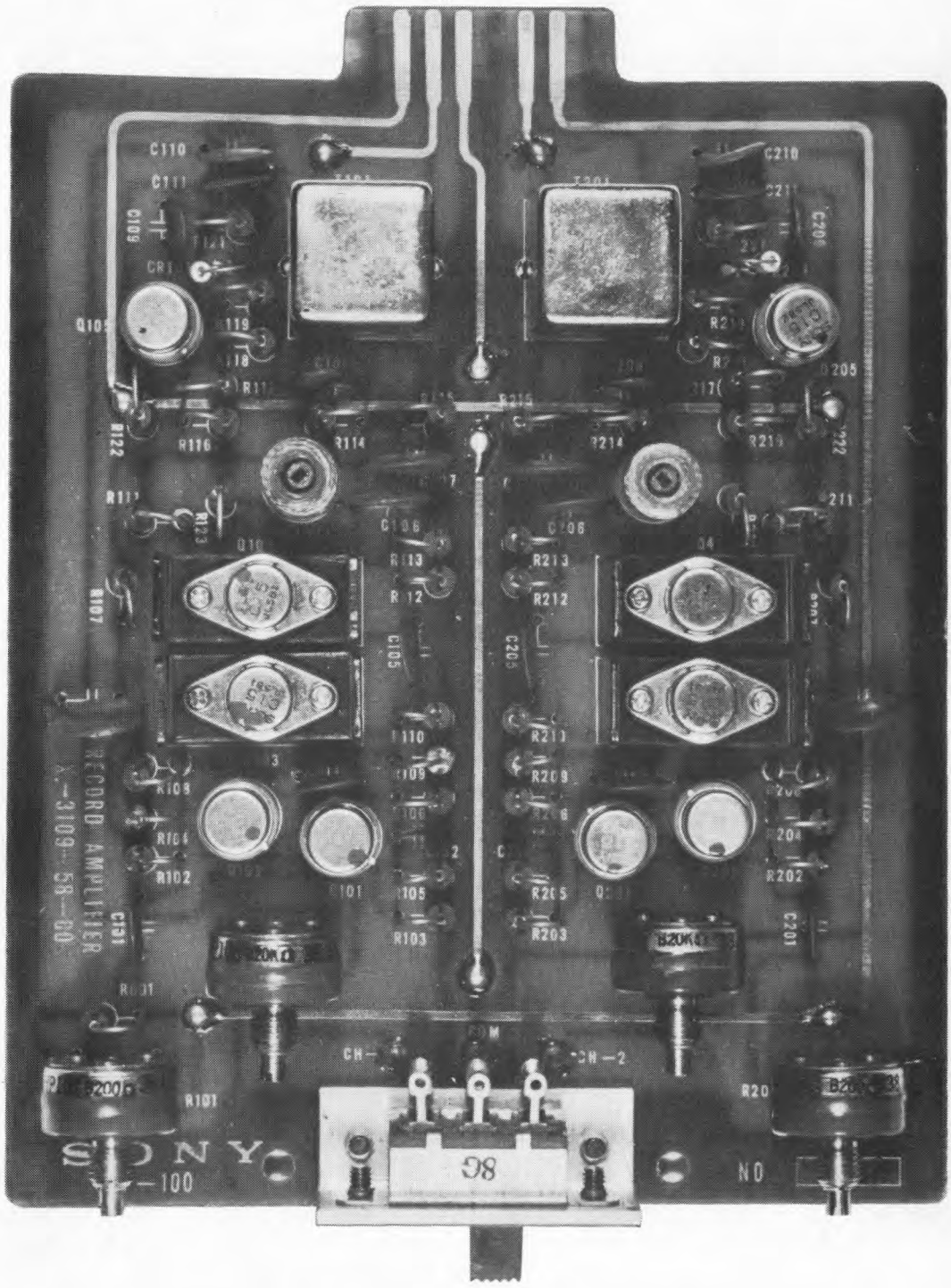
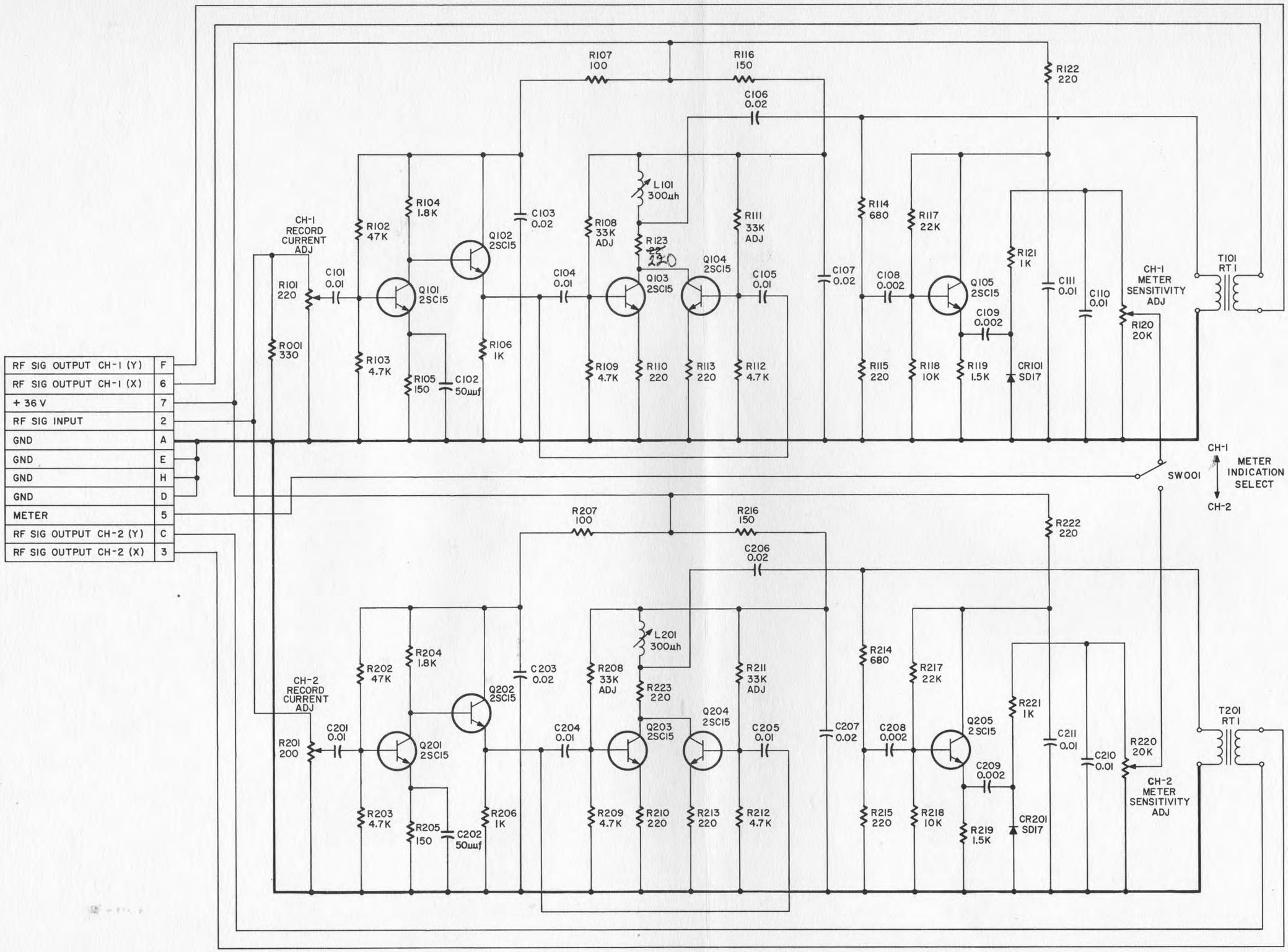


Figure 7-10. Photograph, Record Amplifier



RECORD AMPLIFIER
X-3109-58-00

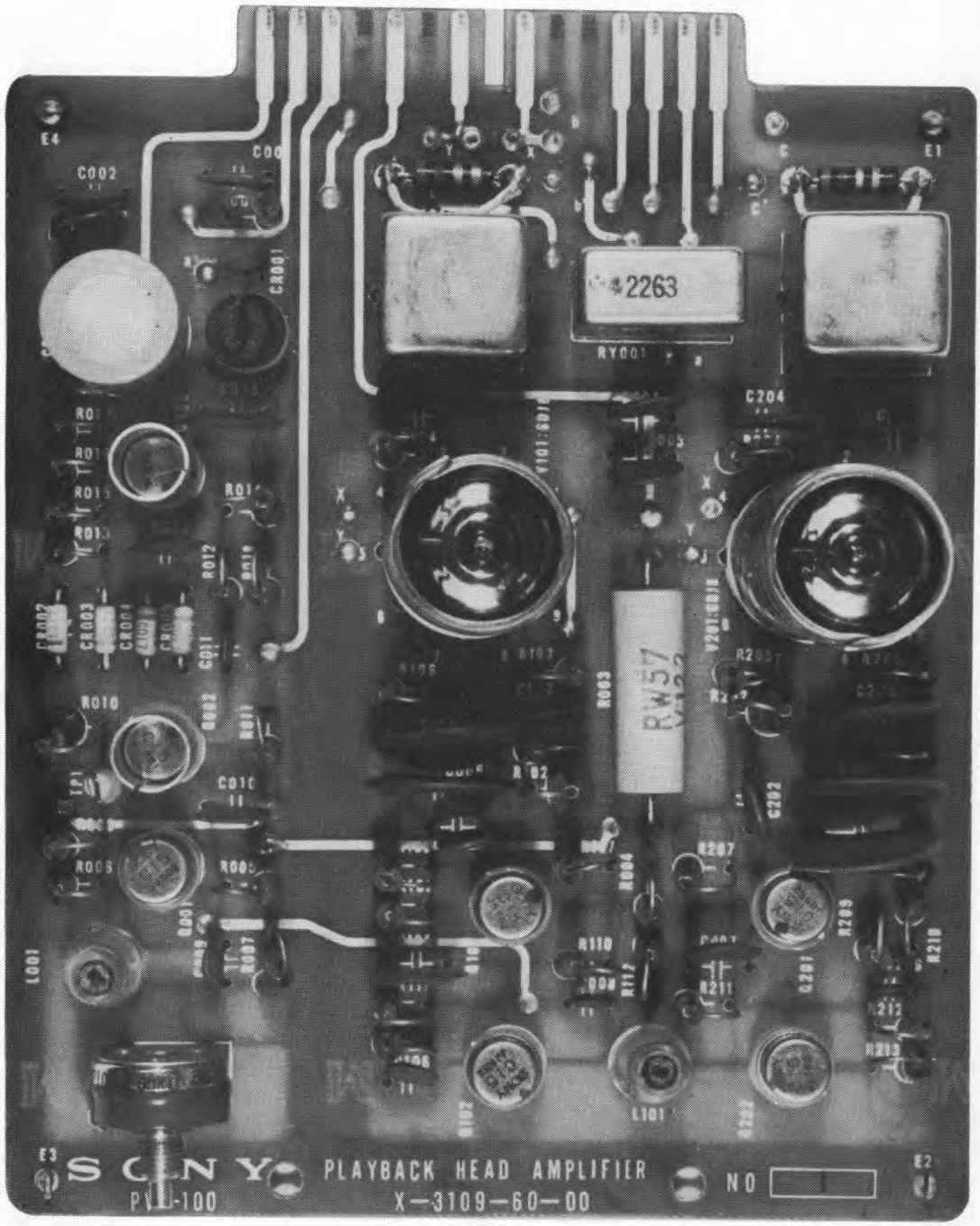


Figure 7-11. Photograph, Playback Head Amplifier

+ 24 V RECORD	14
− 24 V RELAY	E
RF SIG INPUT CH-1 (Y) GND	4
VIDEO SIG HEAD CH-1 (X)	2
RF SIG INPUT CH-2 (X)	1
VERTICAL SYNC HEAD CH-2 (X)	3
REG +24 V	13
+ 250 V	11
AC 6.3 V 2.2 A (X)	7
AC 6.3 V 2.2 A (Y)	9
RF SIG OUT GND	S
−24 V	N
−250 V	L
FRAME GND	F
RF SIG OUTPUT	15
RF SIG INPUT CH-2 (Y) GND	A
VIDEO SIG HEAD CH-1 (Y) GND	B
VERT SYNC HEAD CH-2 (Y) GND	C
RF SIG INPUT CH-1 (Y) GND	D
KEY	8
KEY	J

R001 220
C001 0.01
CR001 1S-121
C002 0.01
C003 100 50V
R002 3.9K
RY001
REC
PB
R003 1.2K 5W, 5%
R102 1.5K 1W, 5%
C101 0.001 500V
V101B 6DJ8
C006 0.01 500V
R103 68
C102 0.05
R105 39K
R106 33K
V101A 6DJ8
C104 0.01 500V
R104 68
C103 0.05
V101 V201
T101 RT-2
R101 5.1
NOTE 1
E1
C004 0.01
C005 0.01
R004 330
R107 68K
R110 47K
R112 560
L101 20μh
Q101 2SC15
Q102 2SC15
C105 0.05
C008 50μμf
R108 15K
R109 1K
R111 15K
C106 100 μμf
R113 120
C007 0.01
E2
R005 39K ADJ
C009 20μμf
L001 20μh
R009 50K RF EQUAL
Q001 2SC15
Q002 2SC15
R006 10K
R008 120
E3
TP1
R011 82
C010 0.01
C011 50μμf
R012 1K
R010 1K 1W
CR002 SD17
CR003 SD17
CR004 SD17
CR005 SD17
C012 0.01
R013 27K
R014 68K
Q003 2SC15
R015 10K
R016 1K
R017 220
R018 330
C013 0.05

R202 1.5K 1W, 5%
C202 50μμf 500V
V201B 6DJ8
C105 0.01 500V
R205 39K
R203 68
C203 0.05
R206 33K
V201A 6DJ8
T201 RT-2
R201 5.1
NOTE 1
C205 0.01 500V
C201 10μμf
C204 0.05
R204 68
R207 68K
Q201 2SC15
R211 47K
R208 15K
R209 330
C206 50μμf
Q202 2SC15
R210 680
R212 15K
R213 120
E4

NOTE
1- SHORTED AFTER THE ADJUSTMENT OF THIS UNIT.

PLAYBACK HEAD AMPLIFIER
X-3109-60-00

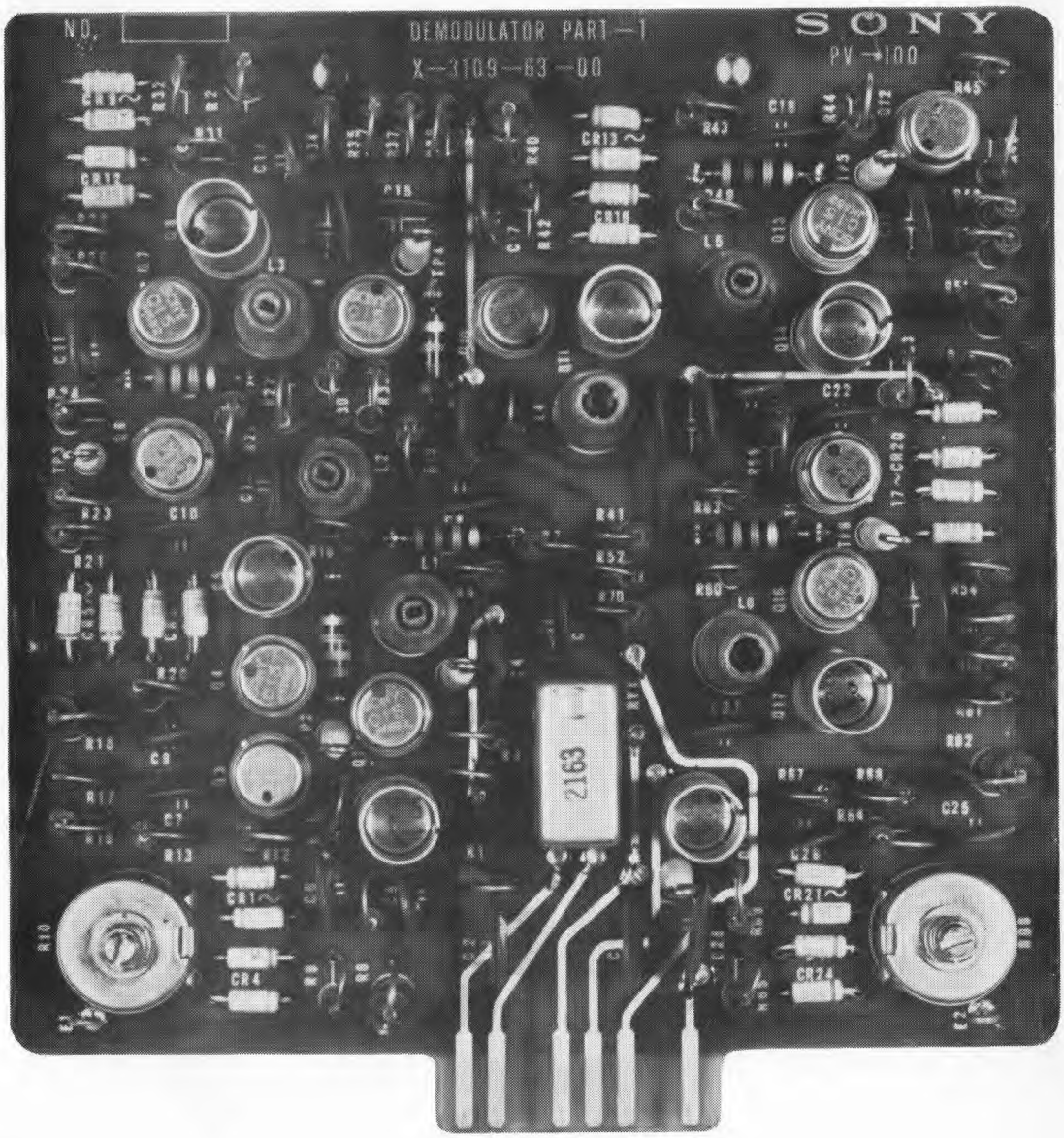
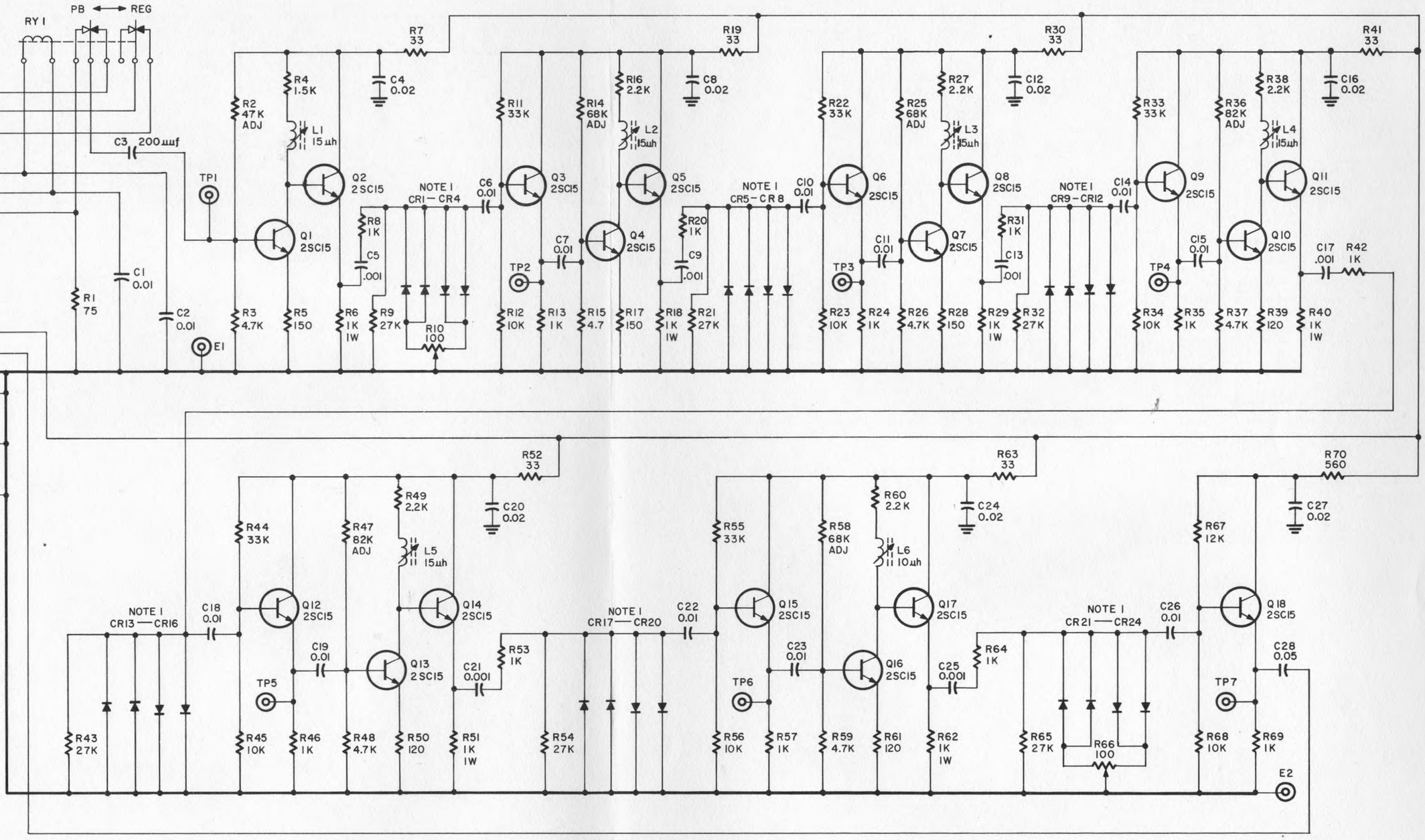


Figure 7-12. Photograph, Demodulator Part 1

RF (E-E) INPUT	1
REG 24V (+)	5
REG 24V (+) TO MOD	E
24V (+) PLAY (DEM RY 101)	C
24V (-) RELAY	4
RF (PB) INPUT	2
36V (+)	6
RF OUTPUT	8
RF (E-E) IN GND	A
RF (PB) IN GND FRAME GND	B
RF OUTPUT GND FRAME GND	H
REG -24V 36V (-)	G



NOTES
1-ALL DIODES ARE SD17

DEMODULATOR PART I
X-3109-63-00

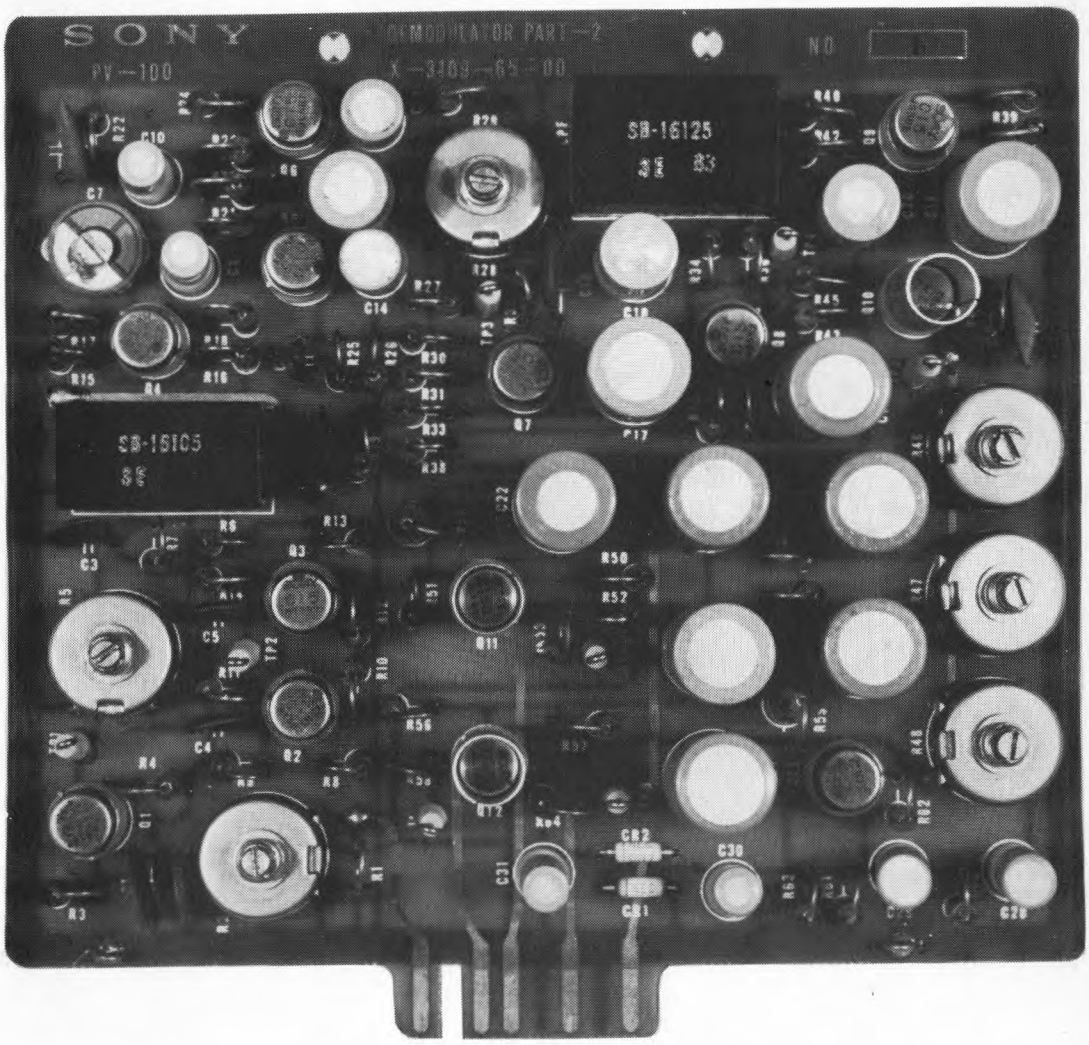
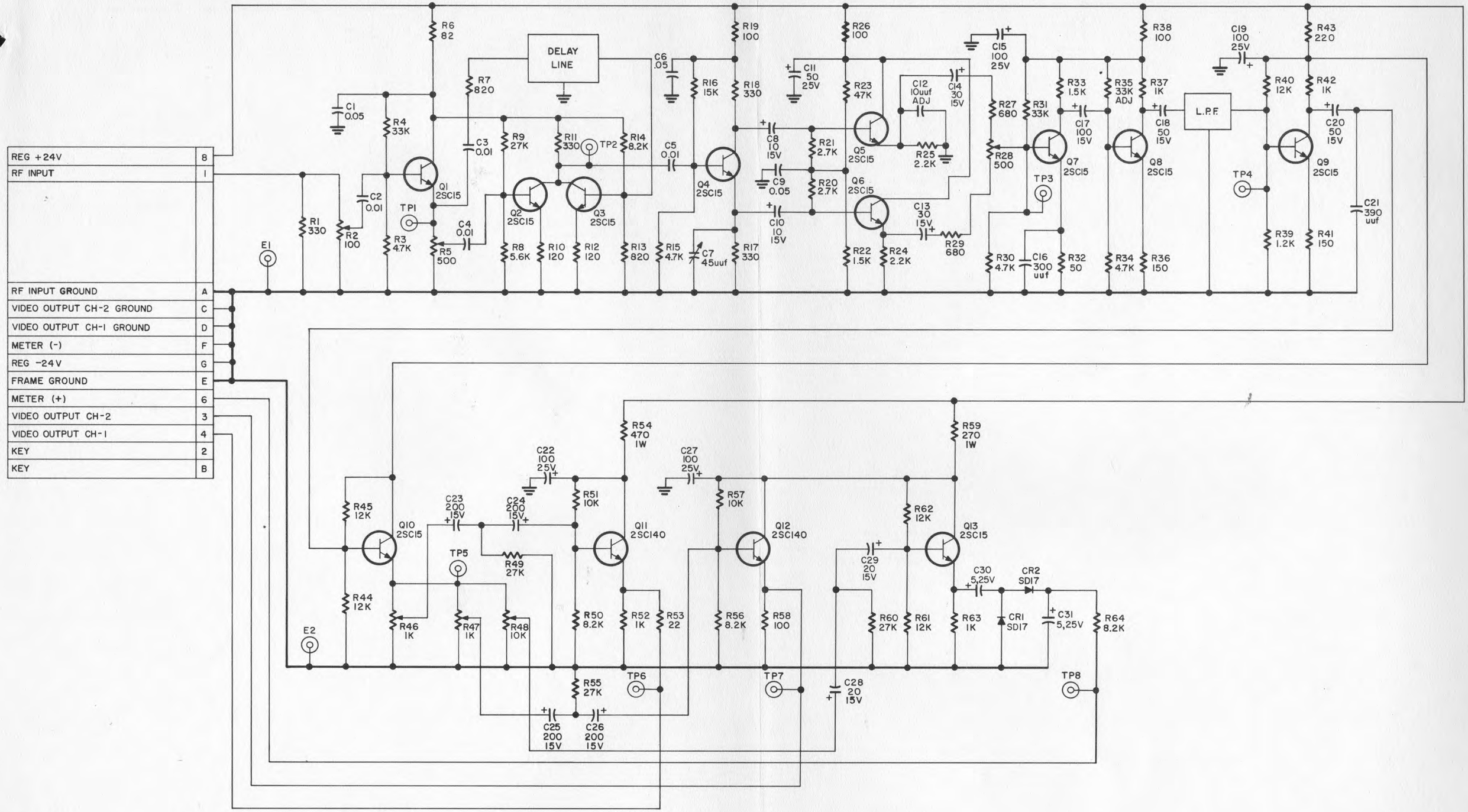


Figure 7-13. Photograph, Demodulator Part 2

REG +24V	8
RF INPUT	1
RF INPUT GROUND	A
VIDEO OUTPUT CH-2 GROUND	C
VIDEO OUTPUT CH-1 GROUND	D
METER (-)	F
REG -24V	G
FRAME GROUND	E
METER (+)	6
VIDEO OUTPUT CH-2	3
VIDEO OUTPUT CH-1	4
KEY	2
KEY	8



DEMODULATOR PART 2
X-3109-65-00

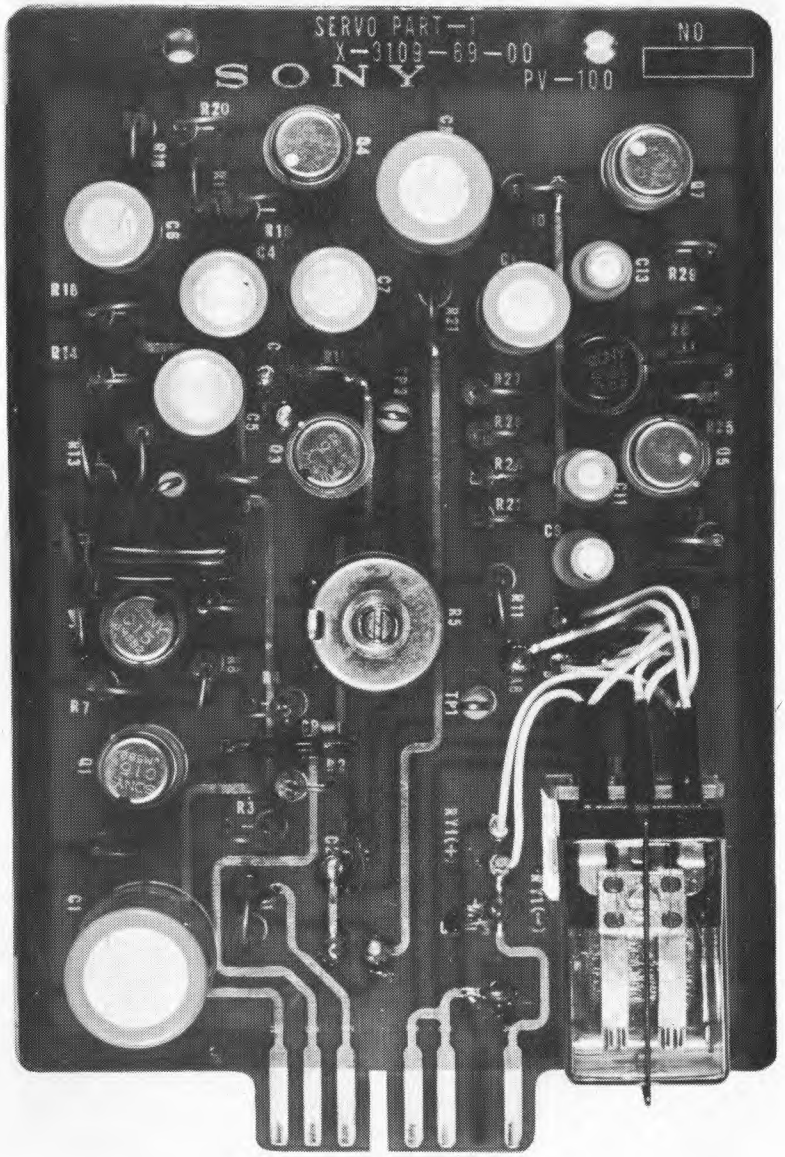
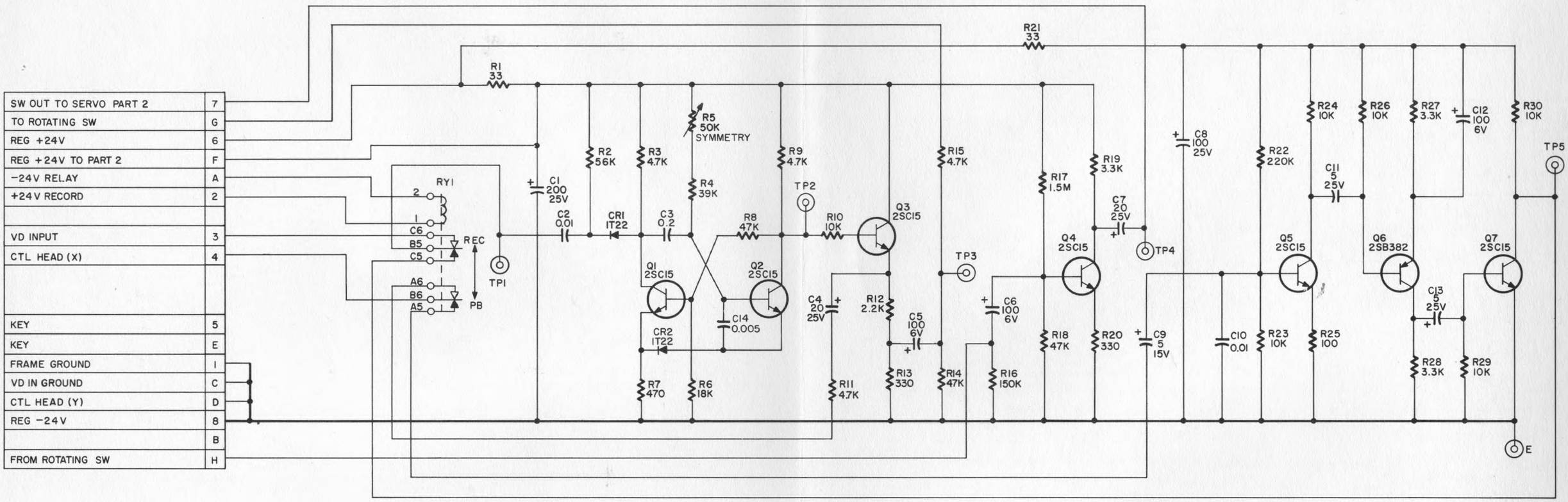


Figure 7-14. Photograph, Servo Part 1



SERVO PART I
X-3109-69-00

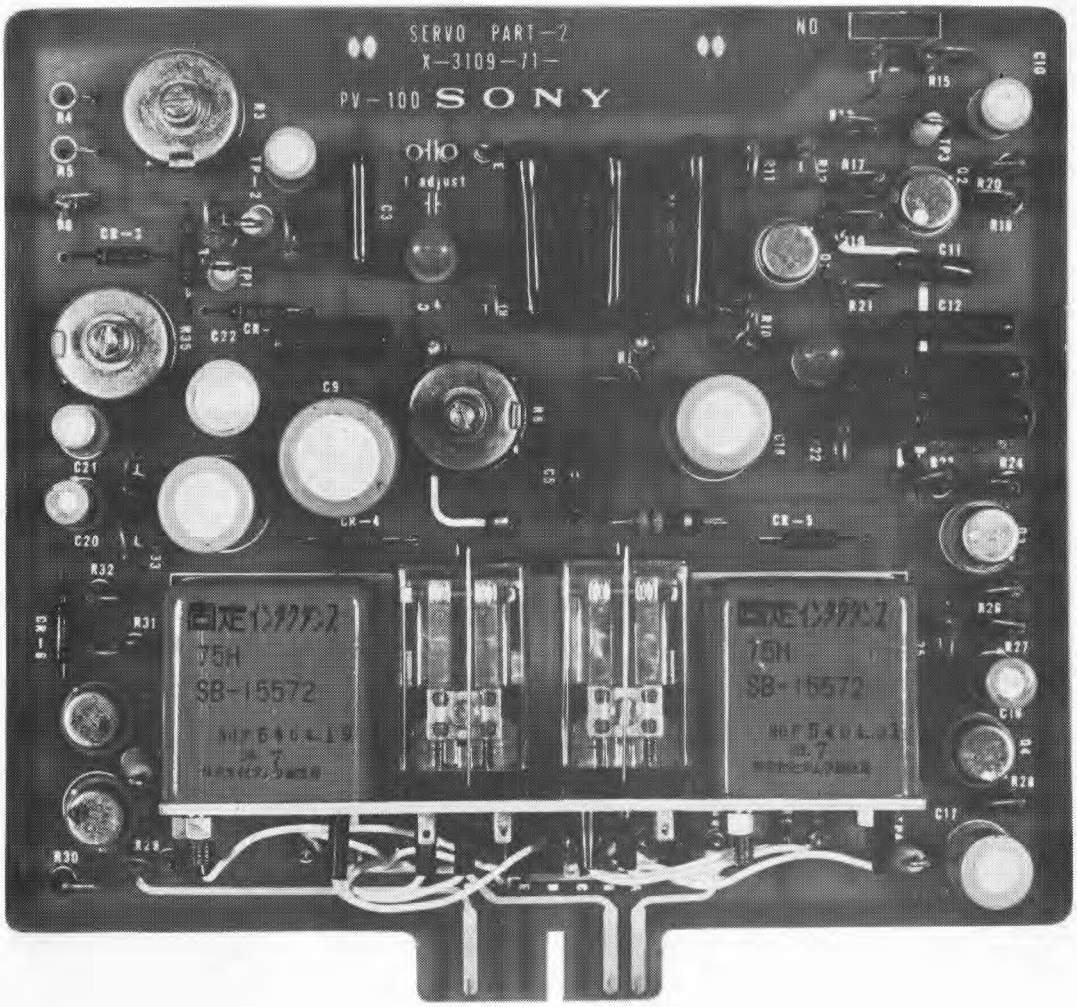
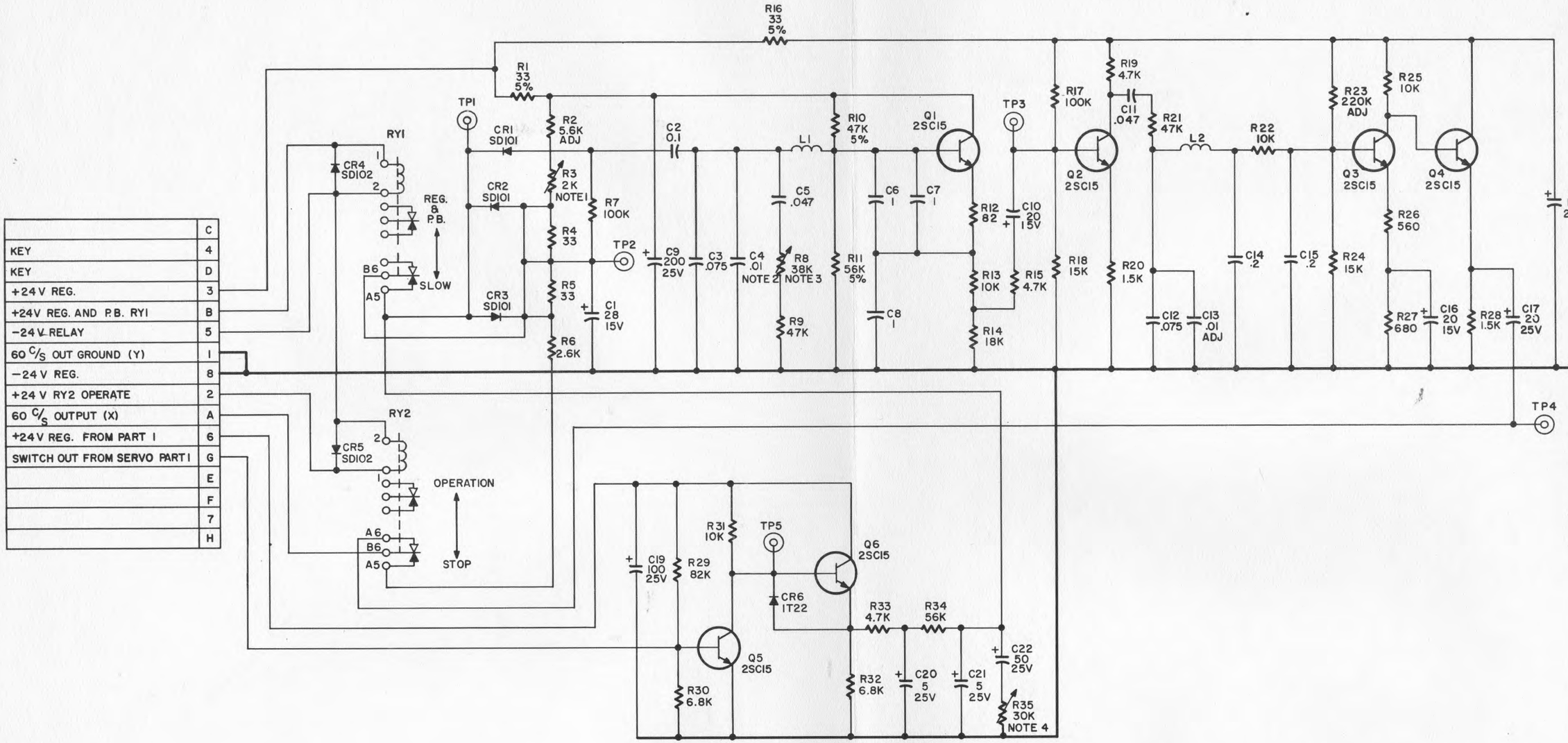


Figure 7-15. Photograph, Servo Part 2

	C
KEY	4
KEY	D
+24 V REG.	3
+24V REG. AND P.B. RYI	B
−24 V RELAY	5
60 $^{C}/_{S}$ OUT GROUND (Y)	I
−24 V REG.	8
+24 V RY2 OPERATE	2
60 $^{C}/_{S}$ OUTPUT (X)	A
+24 V REG. FROM PART I	6
SWITCH OUT FROM SERVO PART I	G
	E
	F
	7
	H



NOTES :

1 — LOCK PHASE ADJUST.
2 — OSCILLATOR FREQUENCY ADJUST.
3 — OSCILLATOR FREQUENCY FINE ADJUST.
4 — LOCK PHASE ADJUST.

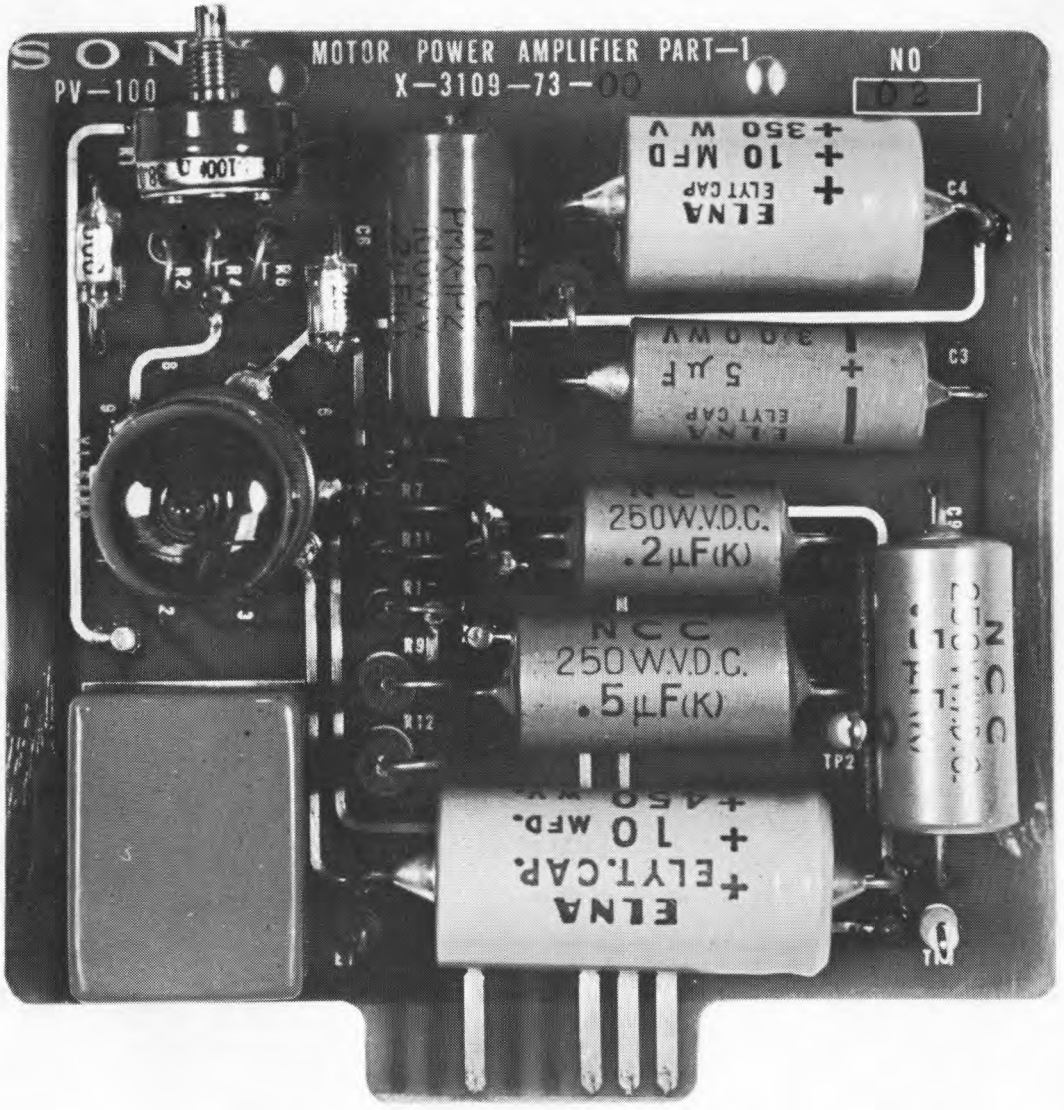
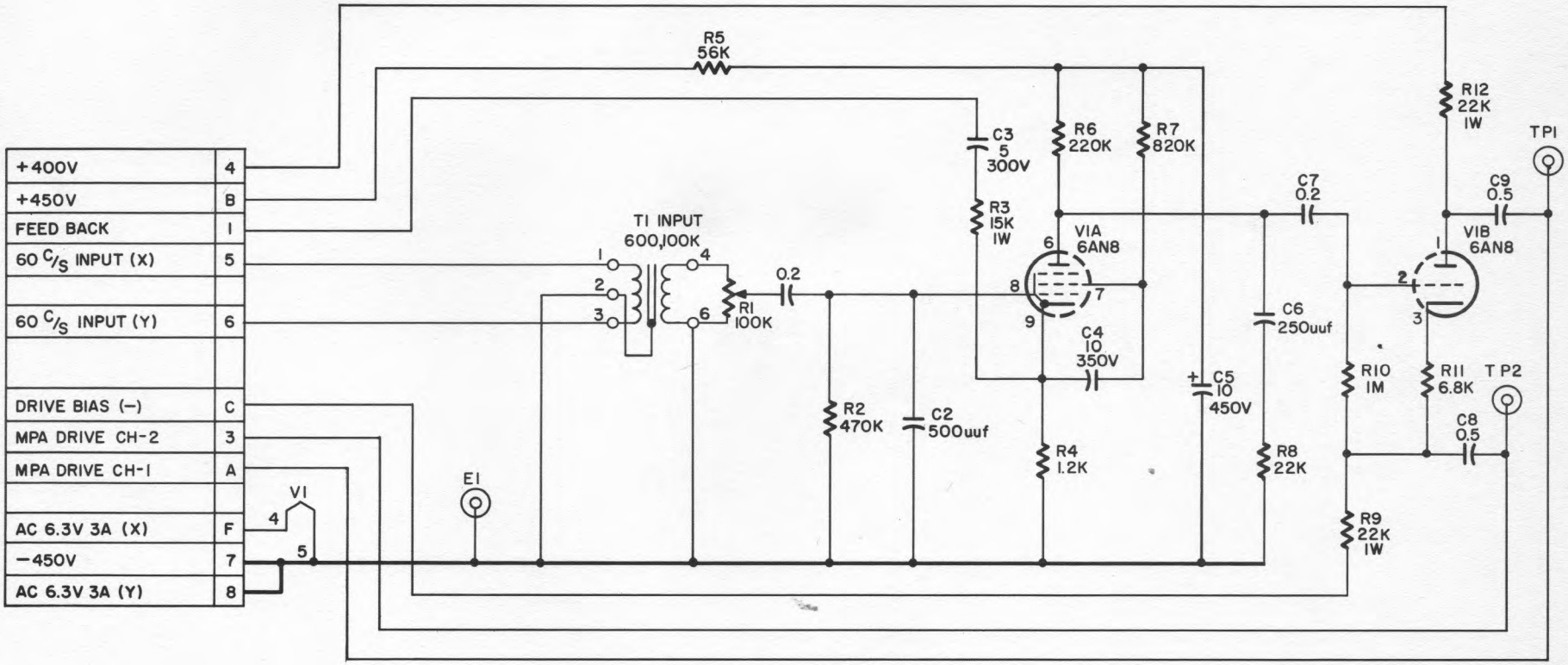


Figure 7-16. Photograph, Motor Power Amplifier Part 1



MOTOR POWER AMPLIFIER
PART I
X-3109-73-00

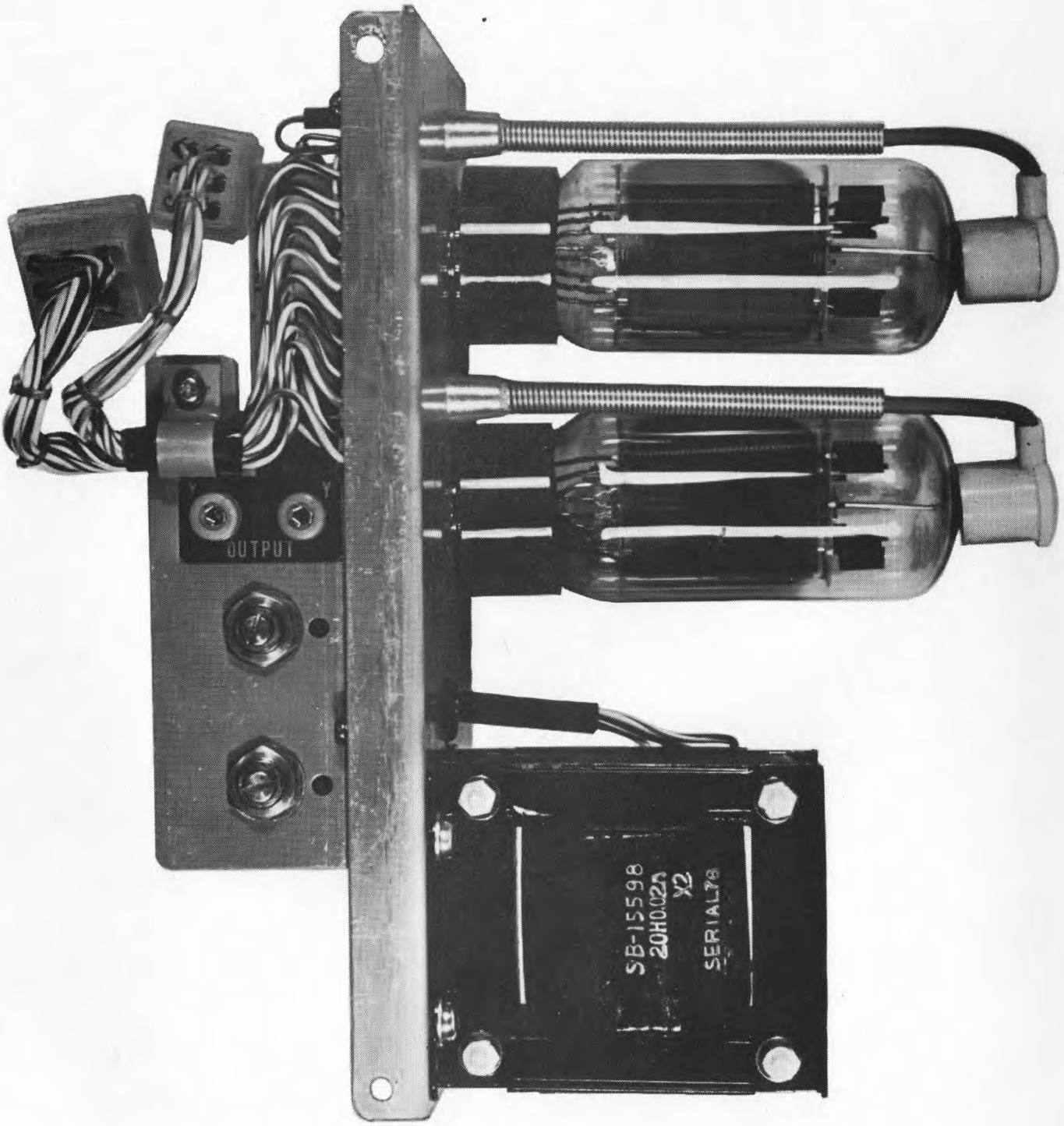
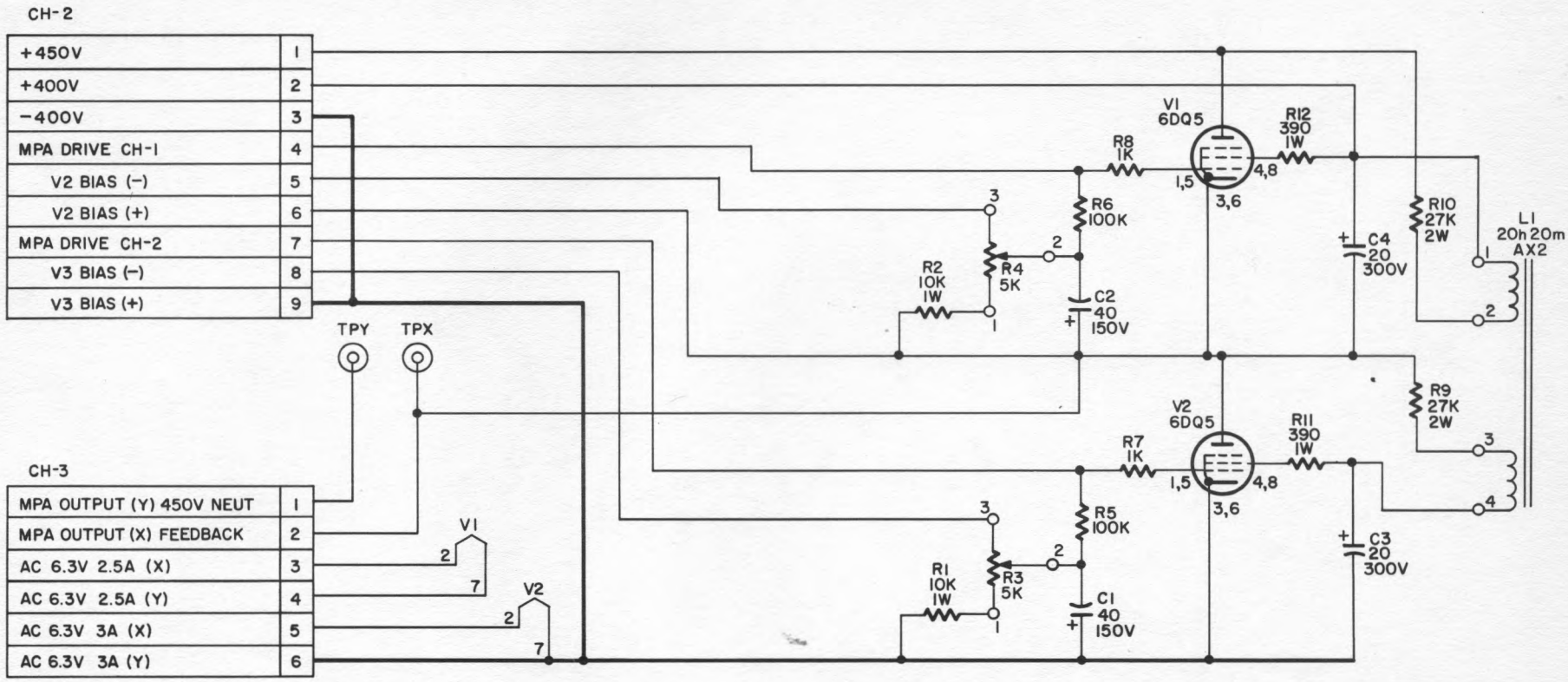


Figure 7-17. Photograph, Motor Power Amplifier Part 2



MOTOR POWER AMPLIFIER
PART 2
X-3109-75-00

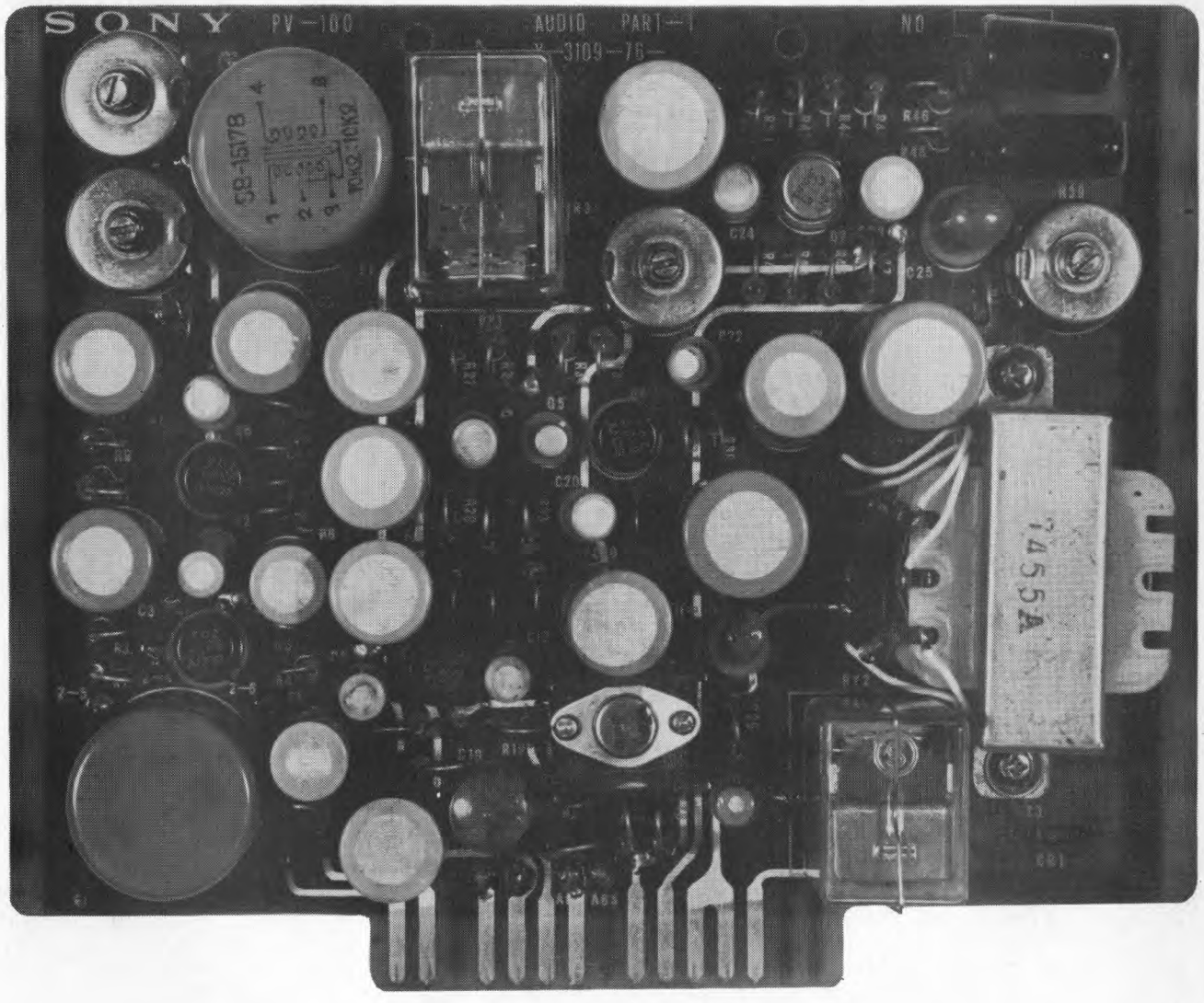


Figure 7-18. Photograph, Audio Amplifier Part 1

LINE INPUT (X)	N
LINE INPUT (Y)	12
MIC INPUT (X)	R
LINE INPUT GROUND	13
MIC INPUT (Y)	5
MIC INPUT GROUND	15
−36 V	8
LINE OUT CH-2 (Y)	E
LINE OUT CH-1 (Y)	D
LINE OUT CH-2 (X)	4
+36 V	H
AUDIO RECORD AMP OUTPUT	F
AUDIO LEVEL CONT 2	M
FROM PB AMP OUT	K
AUDIO LEVEL CONT 3	L
LINE OUT CH-2 GROUND	5
AUDIO RECORD AMP OUTPUT GROUND	6
FROM PB AMP OUT GROUND	9
LINE OUT CH-1 (X) AUDIO MONITOR SW	C
LINE OUT CH-1 (X) AUDIO MONITOR SW	3
AUDIO LEVEL CONT 1	10
−24V RELAY	1
+24 V RELAY (AUDIO RY1, RY2)	2

T1 10K:10K
T2 600 CT 10K
R12 10K
R13 12K
R15 18K
R6 2.2K
R21 1K
R26 10
R2 100K
C1 100 6V
R5 22K
C2 100 6V
R11 4.7K
C5 100 10V
R4 470
C3 100 15V
R8 39K
R10 220
C7 100 15V
Q1 2SB377
Q2 2SB382
C4 10 10V
C6 10 10V
R1 56K
R3 10K
R7 33K
R9 2.2K
R14 10K
R17 100K
R20 10K
R23 47K
R25 4.7K
T3
2700
40
600
C9 10 10V
R19 100
C10 0.1
C11 100 25V
C13 1 10V
C14 0.01
Q3 2SB382
Q4 2SC15
C12 10 10V
C16 100 50V
C8 50 50V
R16 27K
R18 1K
R22 3.3K
R24 100
C15 500 6V
REC
PB
RY2
RY1
a
b
R33 1K
R41 2.2K
R47 100
R29 82K
R32 1K
R35 47K
R38 12K
R43 68K
R45 1.2K
C20 10 10V
R37 100
C26 100 50V
C28 10 25V
R27 1.2K
C18 10 10V
Q5 2SD64
Q6 2SB382
C23 100 25V
Q7 2SC15
C24 10 10V
R48 2.7K
R31 200
R40 1K
R44 100
R46 33
R49 47K
C21 50 50V
C22 5 15V
R39 5K
C25 0.05
C17 100 25V
R28 100K
C19 500 15V
R30 1.5K
R34 33K
R36 2.7K
R42 10K
C27 0.5
C29 0.5

AUDIO PART I
X-3109-76-00

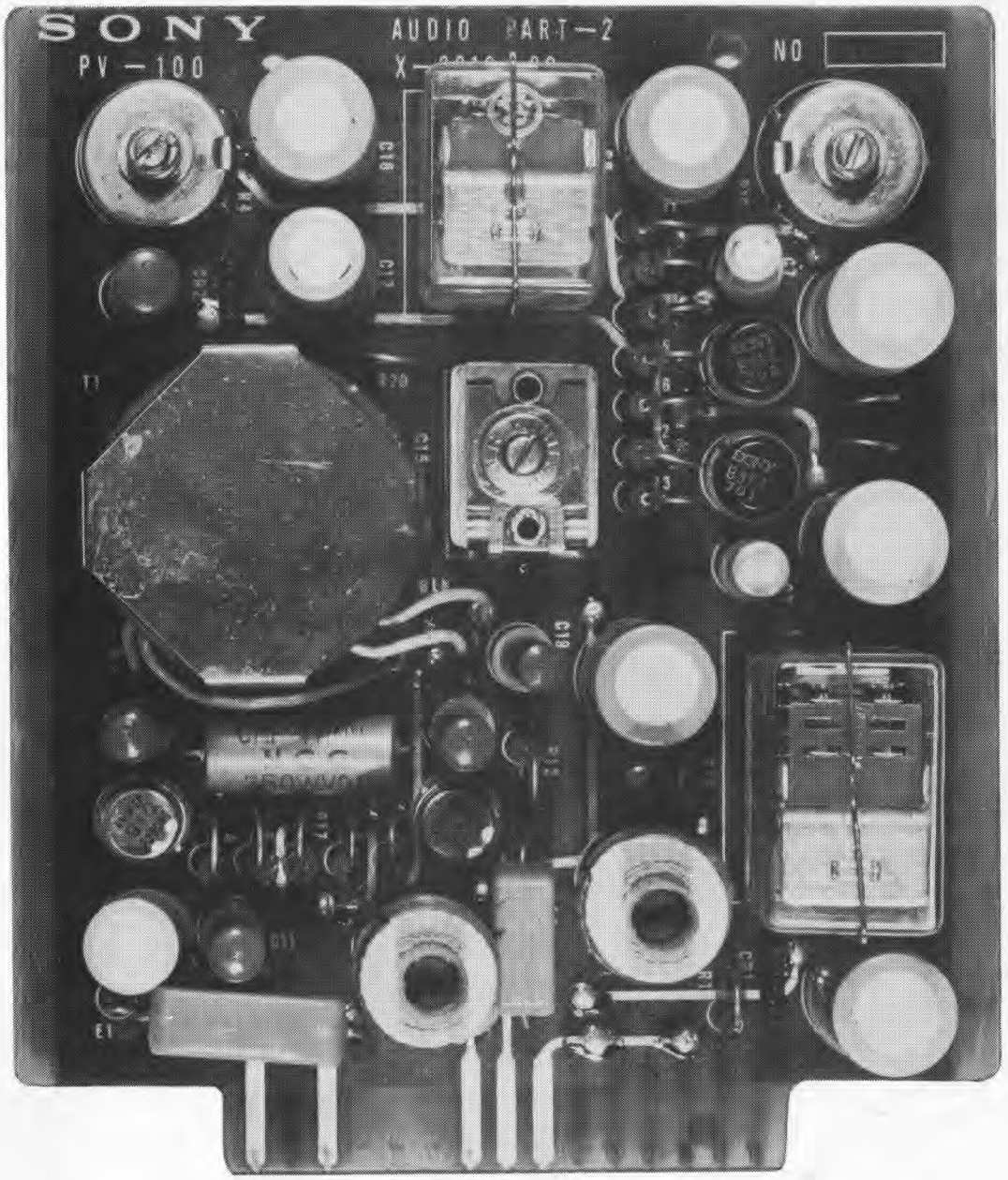
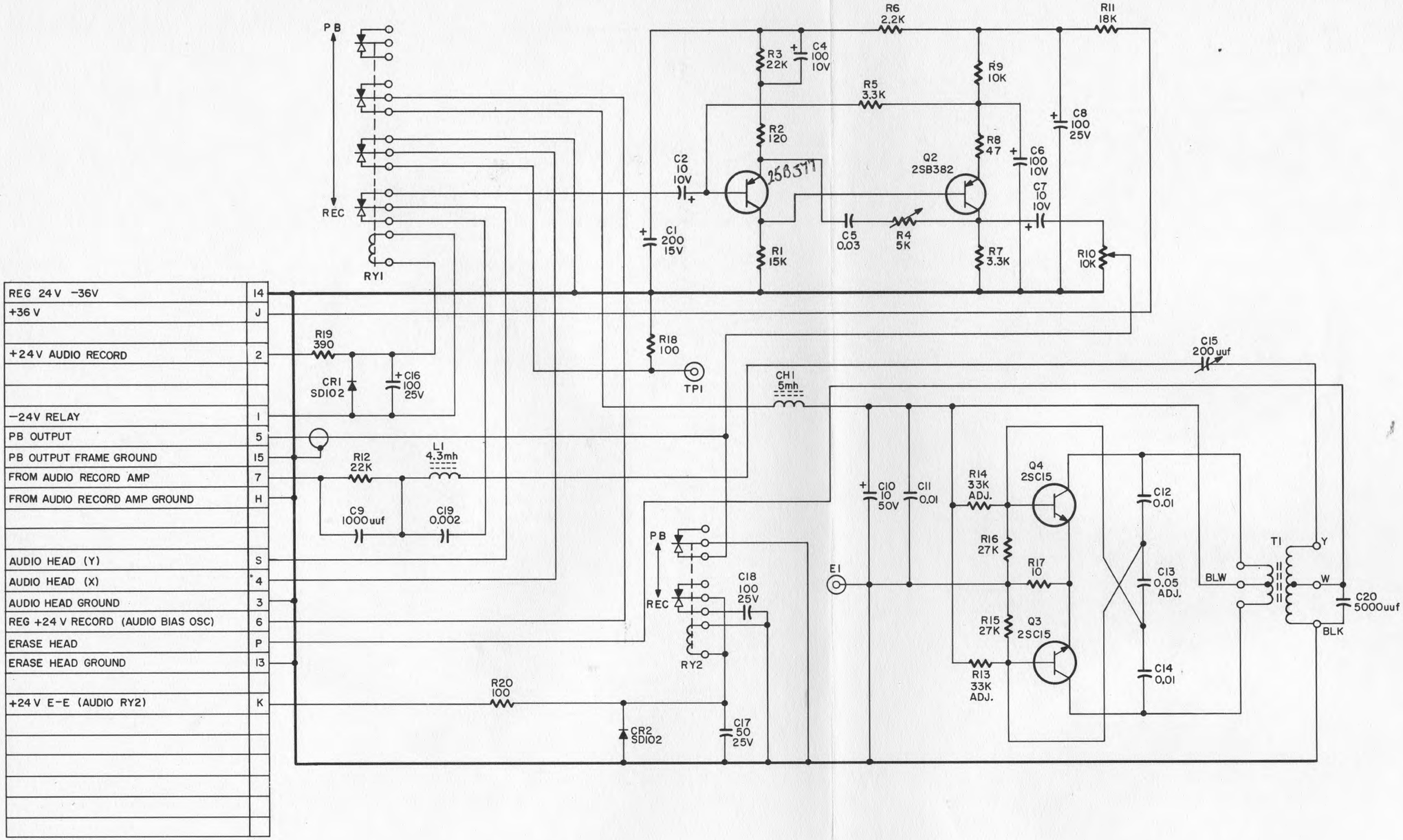


Figure 7-19. Photograph, Audio Amplifier Part 2



AUDIO PART 2
X-3109-80-00

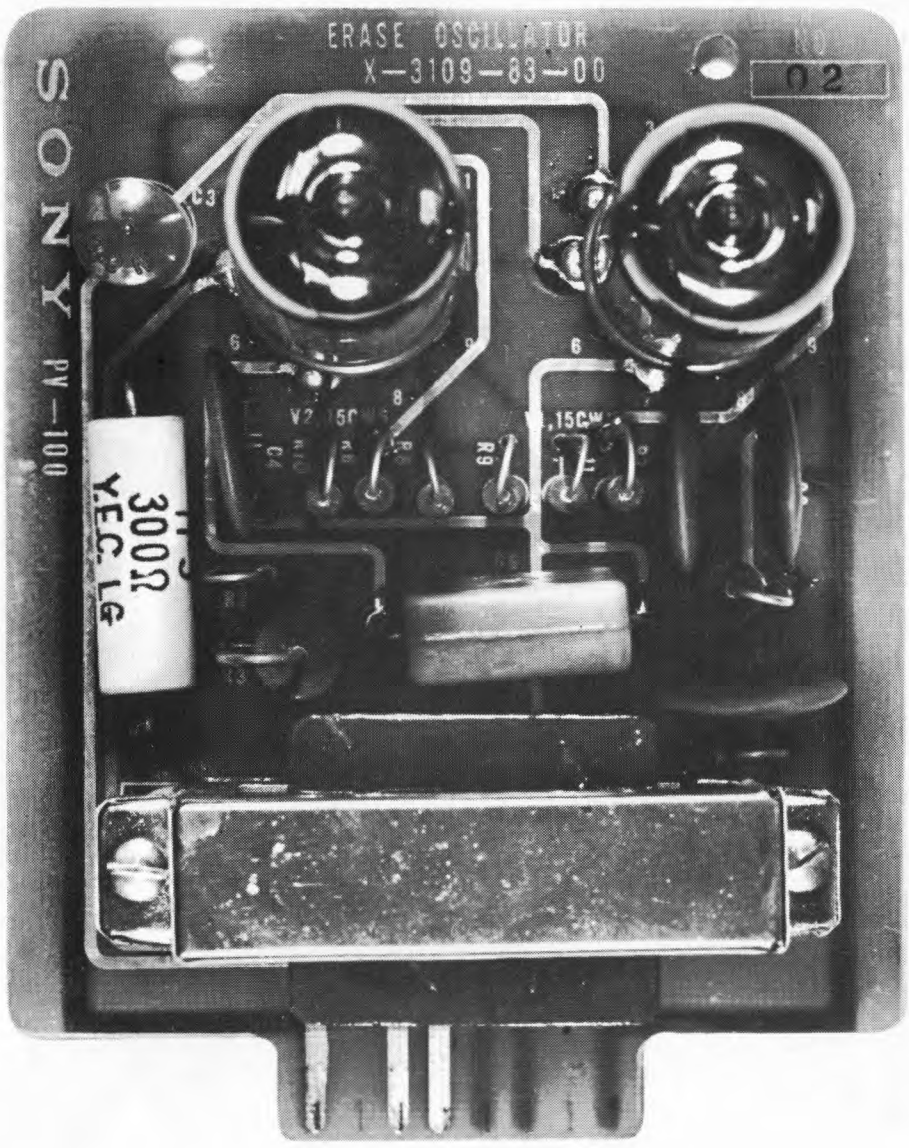
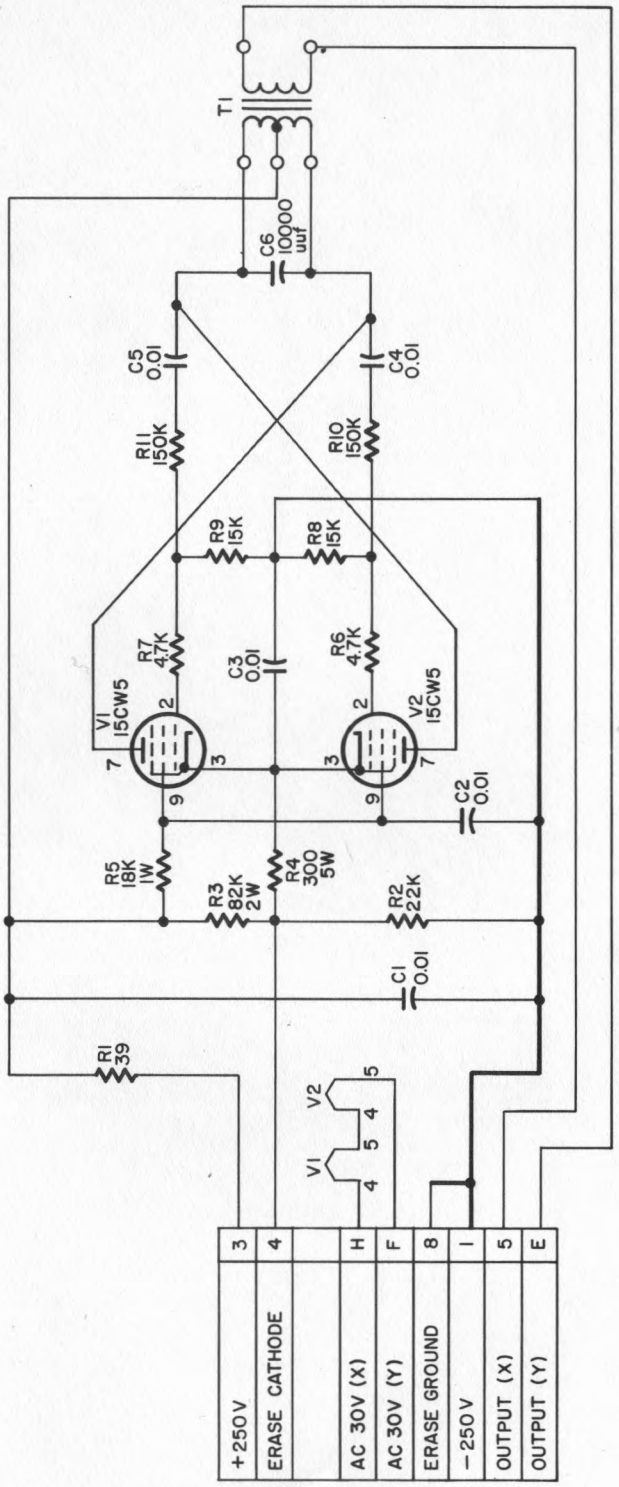


Figure 7-20. Photograph, Erase Oscillator



ERASE OSCILLATOR
X-3109-83-00

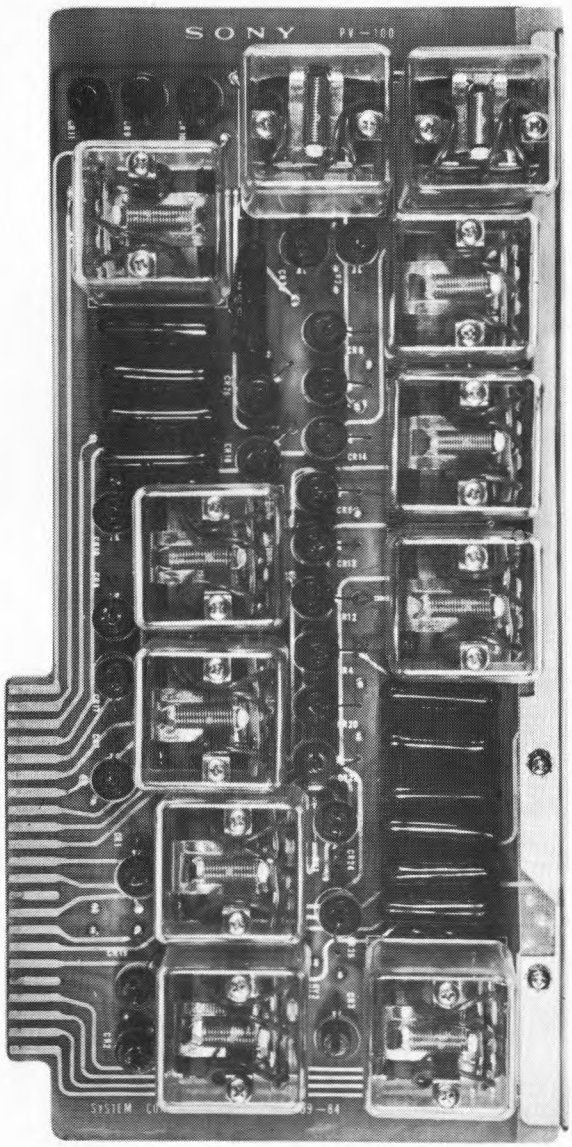
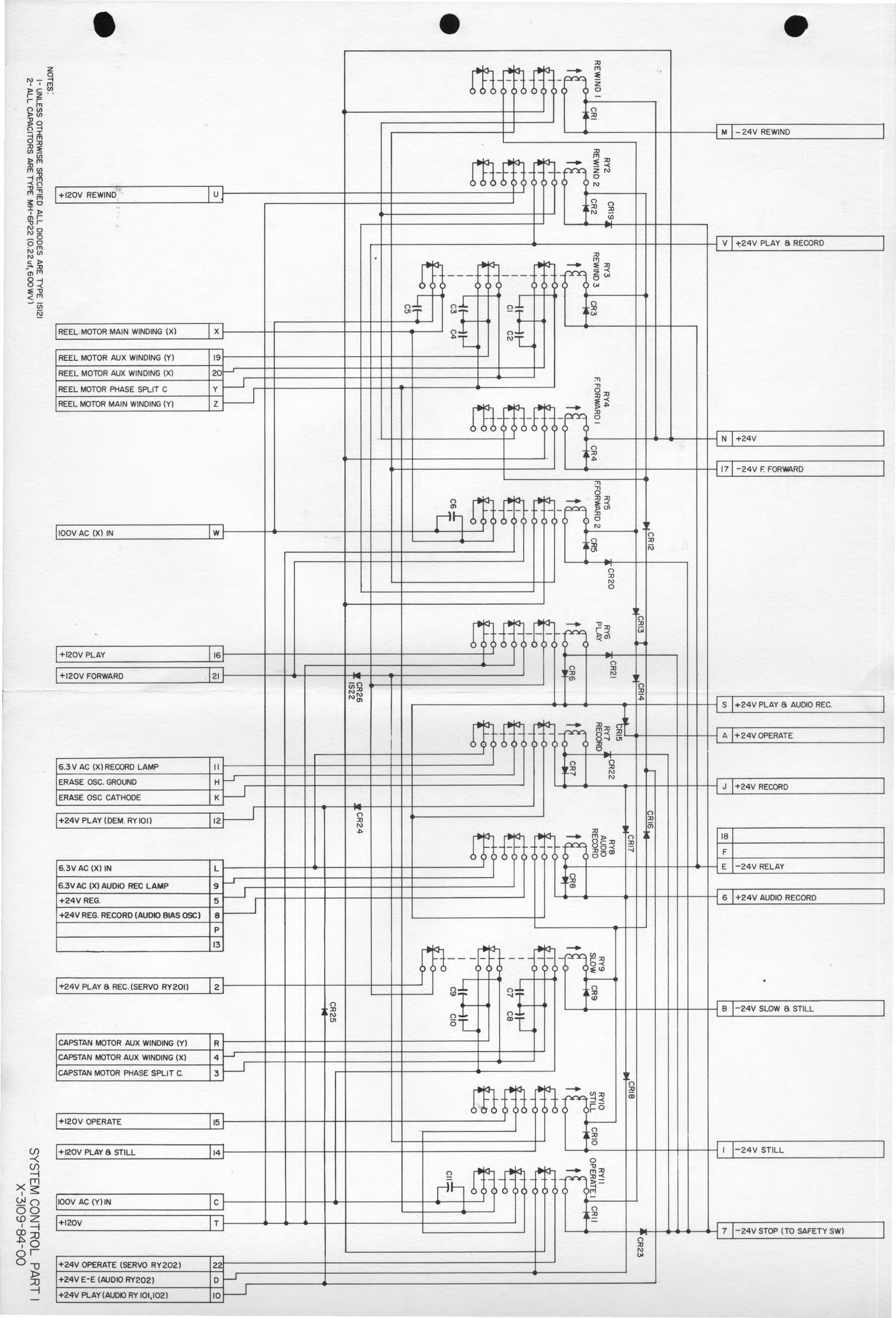


Figure 7-21. Photograph, System Control 1


NOTES:
1- UNLESS OTHERWISE SPECIFIED ALL DIODES ARE TYPE 1S121
2- ALL CAPACITORS ARE TYPE MH-6P22 (0.22 uf, 600 WV)
REWIND 1
CR1
RY2 REWIND 2
CR2
CR19
RY3 REWIND 3
CR3
C5
C3
C4
C1
C2
RY4 F. FORWARD 1
CR4
RY5 F. FORWARD 2
CR5
C6
CR12
CR20
RY6 PLAY
CR6
CR21
CR13
CR14
CR26 1S22
RY7 RECORD
CR7
CR22
CR15
CR24
RY8 AUDIO RECORD
CR8
CR16
CR17
RY9 SLOW
CR9
C9
C10
C7
C8
CR25
RY10 STILL
CR10
CR18
RY11 OPERATE 1
CR11
C11
CR23
M -24V REWIND
V +24V PLAY & RECORD
N +24V
17 -24V F. FORWARD
S +24V PLAY & AUDIO REC.
A +24V OPERATE
J +24V RECORD
18
F
E -24V RELAY
6 +24V AUDIO RECORD
B -24V SLOW & STILL
I -24V STILL
7 -24V STOP (TO SAFETY SW)
+120V REWIND U
REEL MOTOR MAIN WINDING (X) X
REEL MOTOR AUX WINDING (Y) 19
REEL MOTOR AUX WINDING (X) 20
REEL MOTOR PHASE SPLIT C Y
REEL MOTOR MAIN WINDING (Y) Z
100V AC (X) IN W
+120V PLAY 16
+120V FORWARD 21
6.3 V AC (X) RECORD LAMP 11
ERASE OSC. GROUND H
ERASE OSC CATHODE K
+24V PLAY (DEM. RY101) 12
6.3V AC (X) IN L
6.3V AC (X) AUDIO REC LAMP 9
+24V REG. 5
+24V REG. RECORD (AUDIO BIAS OSC) 8
P
13
+24V PLAY & REC. (SERVO RY201) 2
CAPSTAN MOTOR AUX WINDING (Y) R
CAPSTAN MOTOR AUX WINDING (X) 4
CAPSTAN MOTOR PHASE SPLIT C. 3
+120V OPERATE 15
+120V PLAY & STILL 14
100V AC (Y) IN C
+120V T
+24V OPERATE (SERVO RY202) 22
+24V E-E (AUDIO RY202) D
+24V PLAY (AUDIO RY101,102) 10
SYSTEM CONTROL PART 1
X-3109-84-00

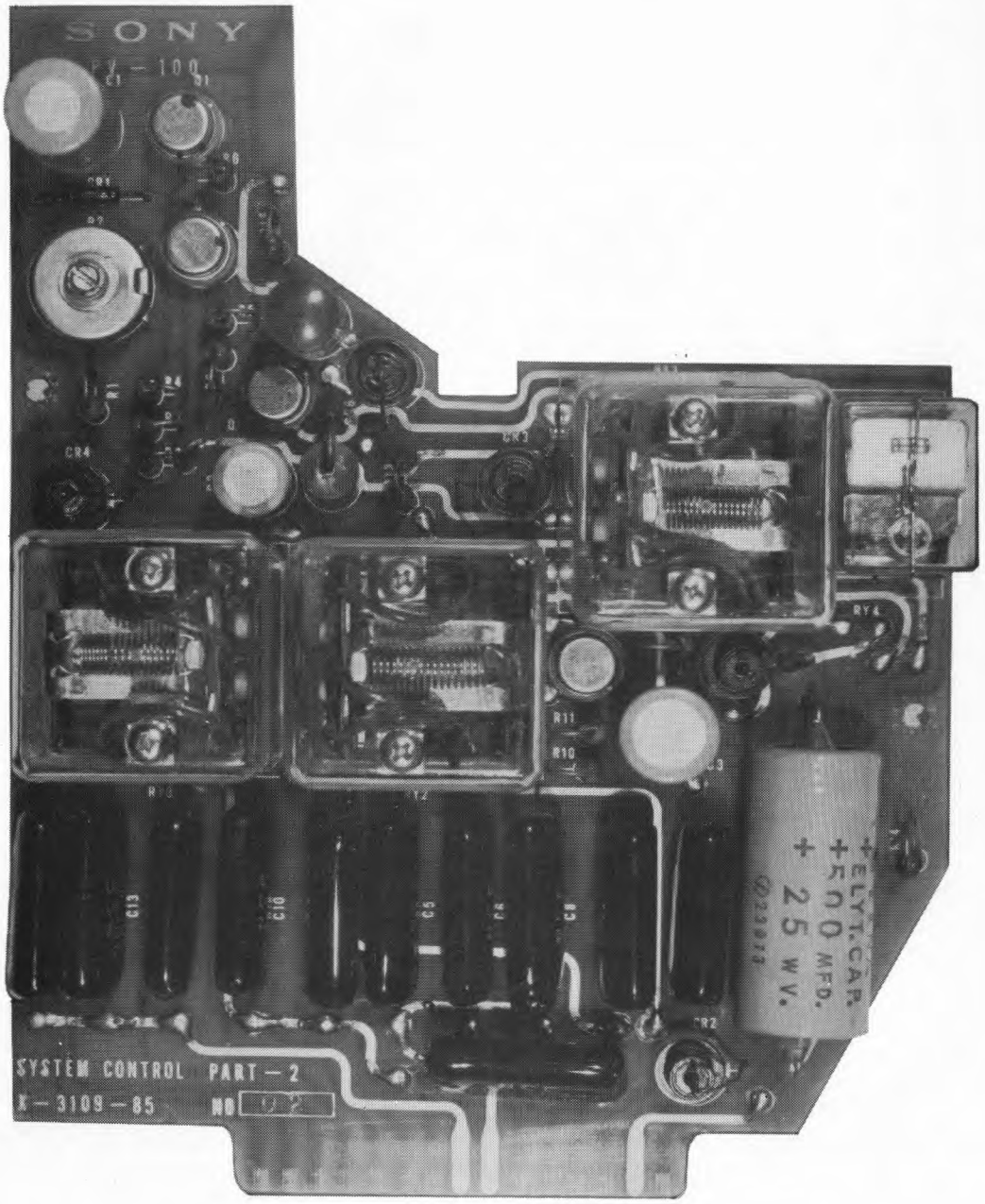
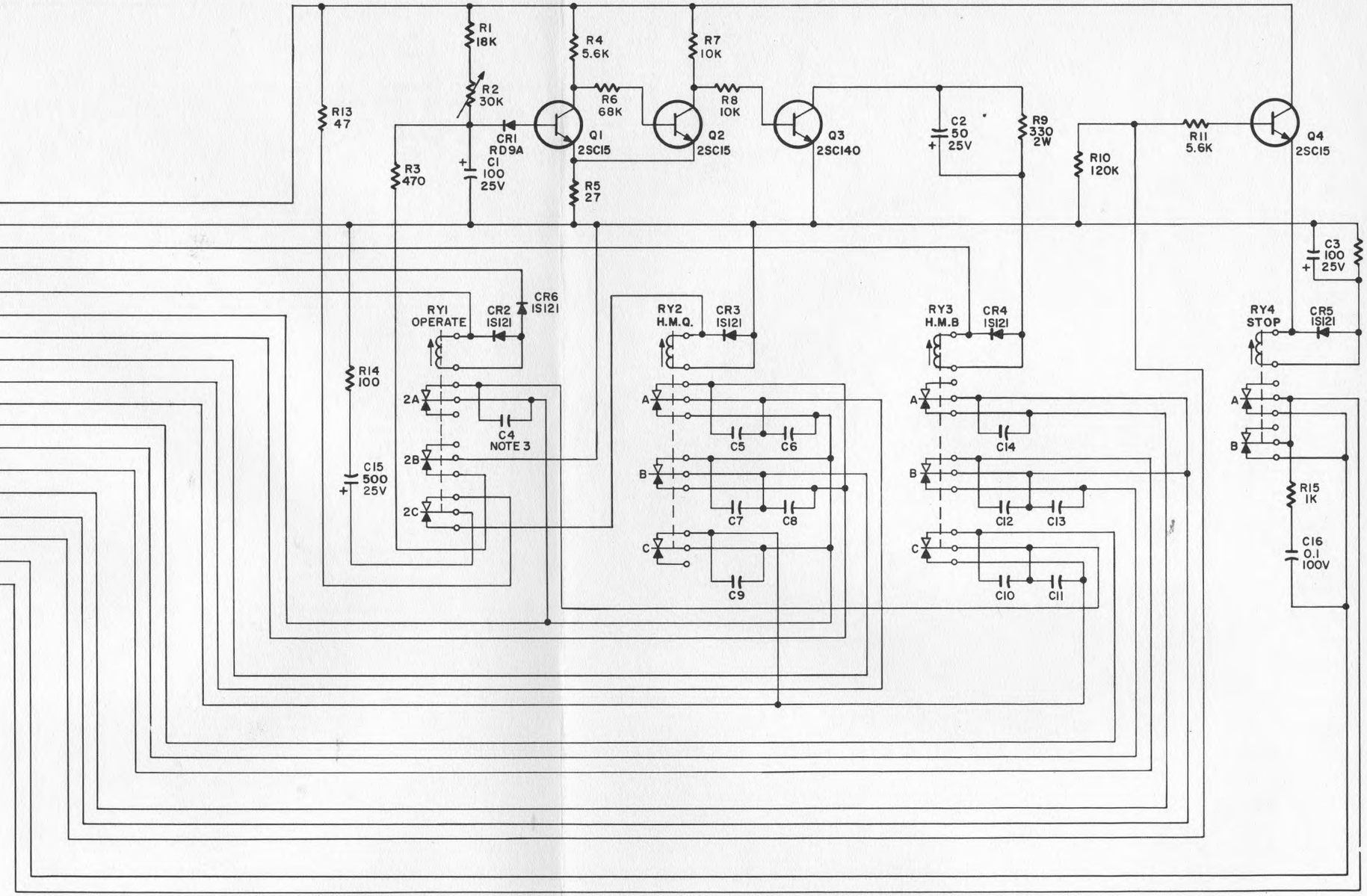


Figure 7-22. Photograph, System Control 2

+24 V REG.	B
−36 V REG. 24 V	A
+36 V	C
−24 V STOP TO SAFETY SW	R
+24 V OPERATE	P
HEAD MOTOR MAIN WINDING (X)	J
HEAD MOTOR PHASE SPRIT C	9
HEAD MOTOR AUX. WINDING (Y)	M
HEAD MOTOR AUX WINDING (X)	K
117 V AC (X)	H
MPA OUTPUT (X)	E
AC LINE (Y)	F
MPA OUTPUT (Y)	D
HEAD MOTOR BUILD UP C	L
HEAD MOTOR MAIN WINDING (Y)	8
AUTOMATIC TAPE STOP SIGNAL IN	N
−24 V STOP (TO LOCAL)	14
−24 V STOP (FROM RELAY ASSY)	S
	1
	2
	3
	4
	5
	6
	7
	10
	11
	12
	13
	15



NOTES :-

1 — H.M.Q. = HEAD MOTOR QUICK STOP
2 — H.M.B. = HEAD MOTOR BUILD UP
3 — C4 TO C14; 0.22 MICROFARADS, 600 VOLTS

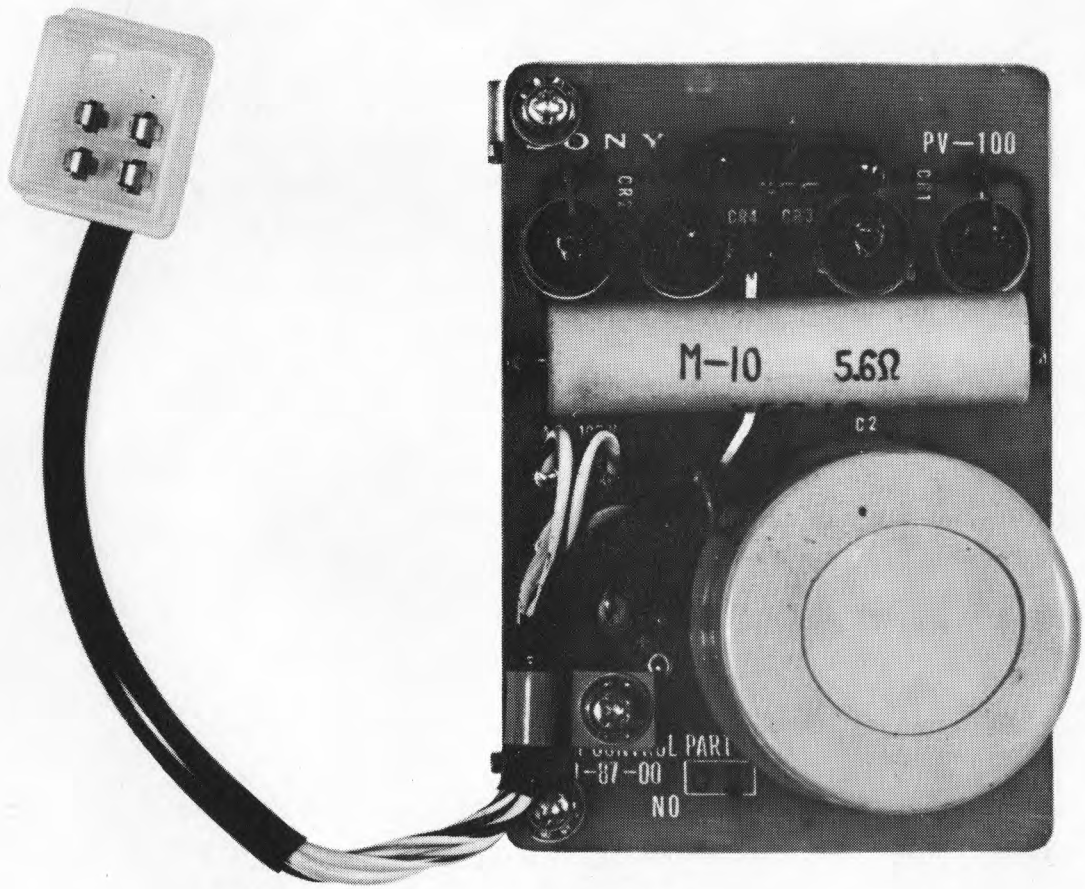
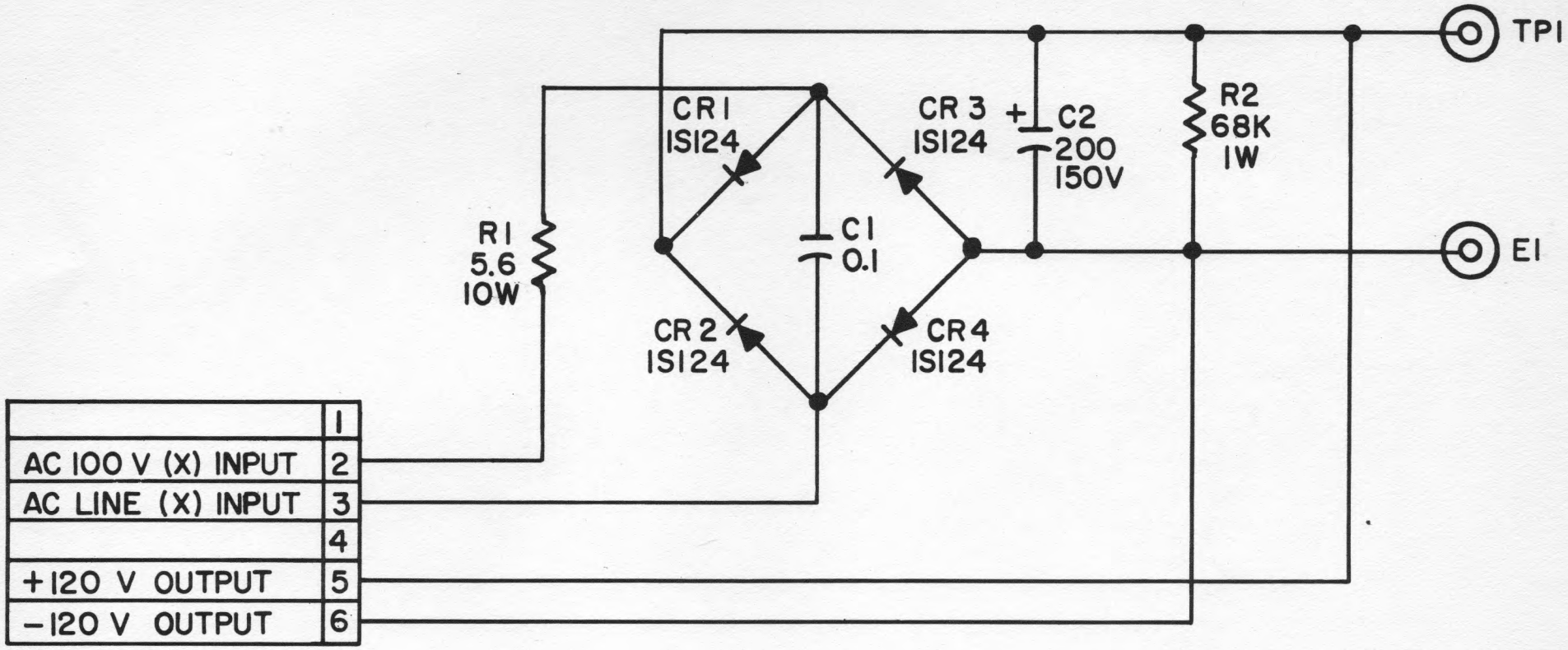


Figure 7-23. Photograph, System Control 3



X-3109-87-00

SYSTEM CONTROL PART 3

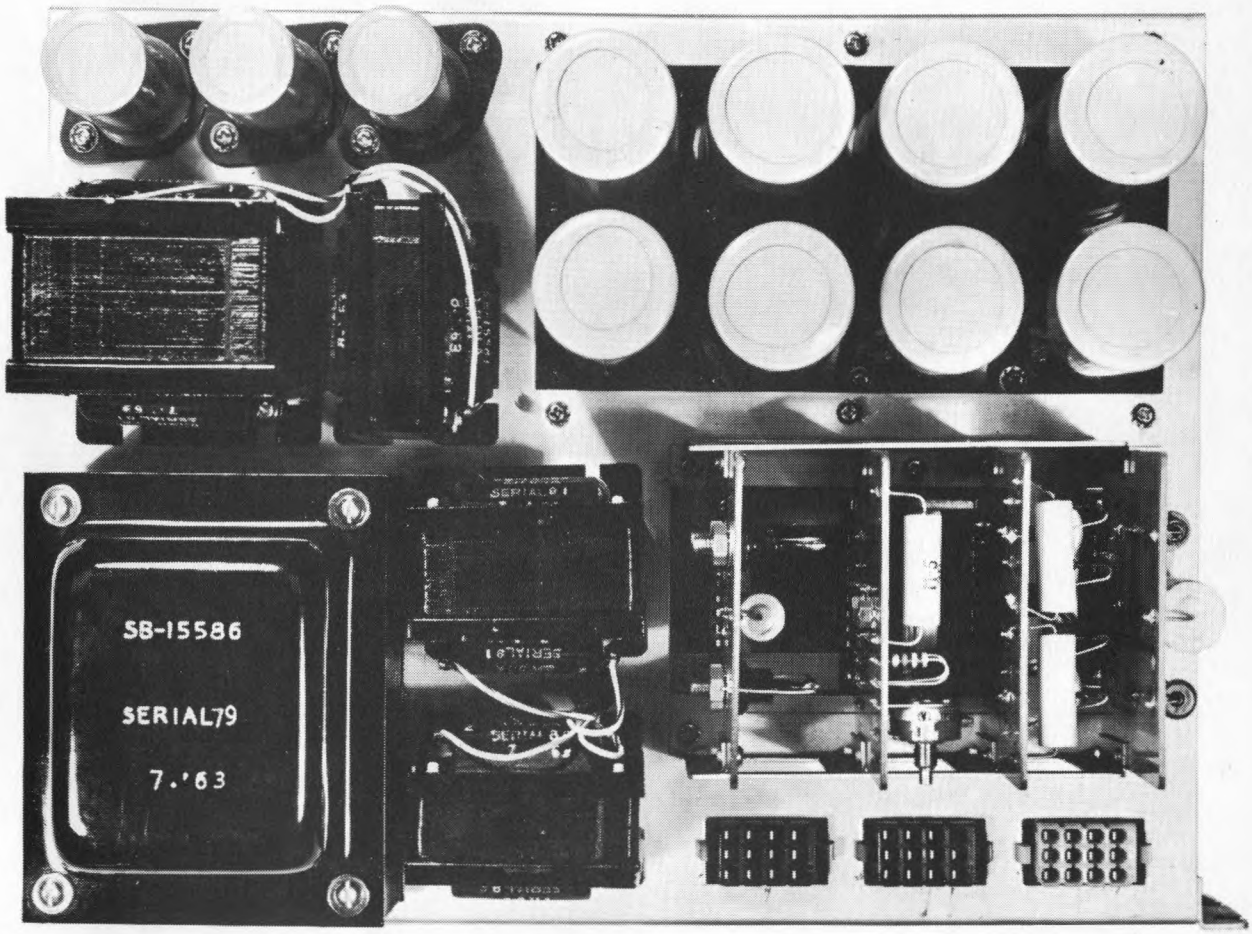


Figure 7-24. Photograph, Power Supply Chassis

TPE (+) V2 BIAS | TPE (−) | TPD (+) V1 BIAS | TPD (−) | TPF (−) 24V | TPF (+) | TPG, H REG 24V 36V(−) | TPH REG 24V(+) | TPG 36V (+) | TPC (−) 250V(ERASE) | TPC (+) | TPB (−) 450V | TPB (+) | TPA (−) 250V | TPA (+)

WHITE

6.3VAC 2.2A (X)	1
6.3VAC 2.2A (Y)	2
6.3VAC 3A (X)	3
6.3 VAC 3A (Y)	4
6.3 VAC 2.5A (X)	5
6.3 VAC 2.5A (Y)	6
117 VAC (X)	7
100VAC (X)	8
100 VAC (X)	9
AC LINE (X)	10
AC LINE (Y)	11
AC LINE (Y)	12

BLUE

36V (+)	1
REG 24 V (+)	2
REG 24 V (+)	3
REG 24 V, −36V	4
REG 24 V, −36V	5
REG 24 V, −36V	6
24 V (+)	7
24 V (−)	8
24 V (−)	9
250 V (+)	10
250 V (−)	11
	12

RED

450 V (+)	1
450 V (−)	2
450 V NEUTRAL	3
V1 BIAS (−)	4
V1 BIAS (+)	5
V2 BIAS (−)	6
V2 BIAS (+)	7
250 V (+) ERASE	8
250 V (−) ERASE	9
30V AC (X)	10
30 VAC (Y)	11
GROUND	12

R002 4.7K 1W

C002A 1000 50V

C002B 1000 50V

T001

117V (X)
100V (X)
100 V
AC LINE
30V (X)
AC LINE (Y)
6.5V(X)2.2A
6.5V (Y)
6.5V(X)3A
6.5V (Y)
6.5V(X)2.5A
6.5V (Y)

33V (X)
33V (Y)
21V (X)
CT (Y)
21V (Z)
195V (X)
195 (Y)
55V (X)
55V (Y)
55V (X)
55V (Y)

L001 0.15h 1A

C001A 1000 50V

C001B 1000 50V

R001 3.3K 1W

L002 2h 0.1A

C003A 100 350V

C003B 100 350V

R003 56K 2W

L003 1h 0.2A

C004 200 350V

C006 200 350V

R004 68K 2W

C005 200 350V

C007 200 350V

R005 68K 2W

L004 1h 0.1A

C008A 100 350V

C008B 100 350V

R006 100K 1W

C021 200 150V

C022 200 150V

C023 200 150V

PS 1

1	33V AC (Y) INPUT	A	36V DC (+) OUTPUT
2		B	
3		C	21V AC (Z) INPUT
4		D	24V DC (+) OUTPUT
5		E	21V AC (X) INPUT
6	KEY	F	KEY
7		G	
8	33V AC (X) INPUT	H	36V DC (−) OUTPUT

PS 2

1	36V DC, REG 24V (−)	A	
2		B	
3		C	
4		D	
5	KEY	E	
6	KEY	F	
7		G	
8	36V DC (+) INPUT	H	REG 24V (+) OUTPUT

PS 3

1	100V AC INPUT (2)	A	70V AC (−) OUTPUT (2)
2	450 V DC (−)	B	55VAC (X) INPUT (2)
3		C	55 V AC (Y) INPUT (2)
4	KEY	D	KEY
5		E	AC LINE (Y)
6		F	55VAC (X) INPUT (1)
7	450 V DC (+)	G	55V AC (Y) INPUT (1)
8	100VAC INPUT (1)	H	70V DC (−) OUTPUT (1)

PS 4

1	250V DC (−) OUTPUT	A	
2		B	195 V AC (X) INPUT
3	KEY	C	
4	KEY	D	195 VAC (Y) INPUT
5		E	100VAC INPUT
6		F	250V (+) (ERASE)
7	250 V (−) (ERASE)	G	
8		H	250 V DC (+) OUTPUT

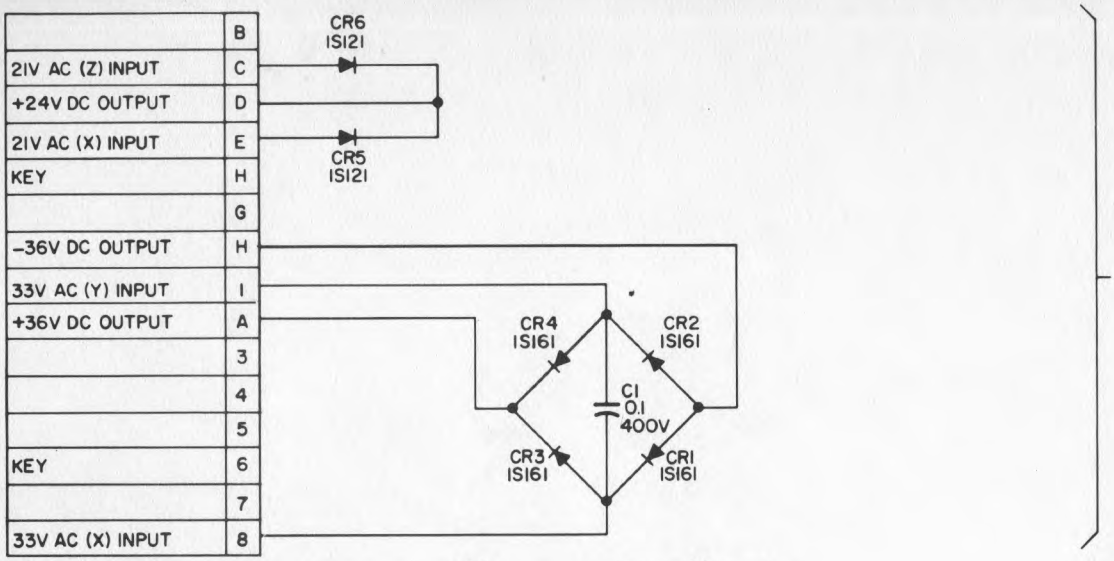
POWER SUPPLY
X-3109-88-00

TAPE TRANSPORT
(S.C.1 S.C.2)
FAN
CONTROL PANEL
METER
POWER SWITCH
INTER LOCK SW
FUZE
AC IN
CONNECTOR PANEL
117V
100V
33V
CT 21V
195V
6.5V 2.2A
55V(1)
55V(2)
30V
6.5V 2.5A
6.5V 3A
PS1
PS2
PS3
PS4
L001 0.15H
C001A 1000uf
C001B 1000uf
R001 3.3K
C002A 1000uf
C002B 1000uf
R002 4.7K
L002 2H
C003A 1000uf
C003B 1000uf
R003 56K
C022 200uf
C021 200uf
C023 200uf
L003 1H
C004 200uf
C005 200uf
C006 200uf
C007 200uf
R004 68K
R006 100K
L004 1H
C008A 100uf
C008B 100uf
R006 100K
TPG
TPH
TPF
TPA
TPD
TPE
TPB
TPC
36V
24V
250V
70V
450V
24V RELAYS
MOD1
MOD2
DEM1
DEM2
SVO1
SVO2
PBHA
RECA
AUD1
AUD2
SC2
LAMPS
MPA 1
MPA 2
VIA
VIB
VI
V2
60 c/s TO SERVO PART 1
S.C.1
M HEAD MOTOR
TO ERASE HEAD
ERASE OSCILLATOR

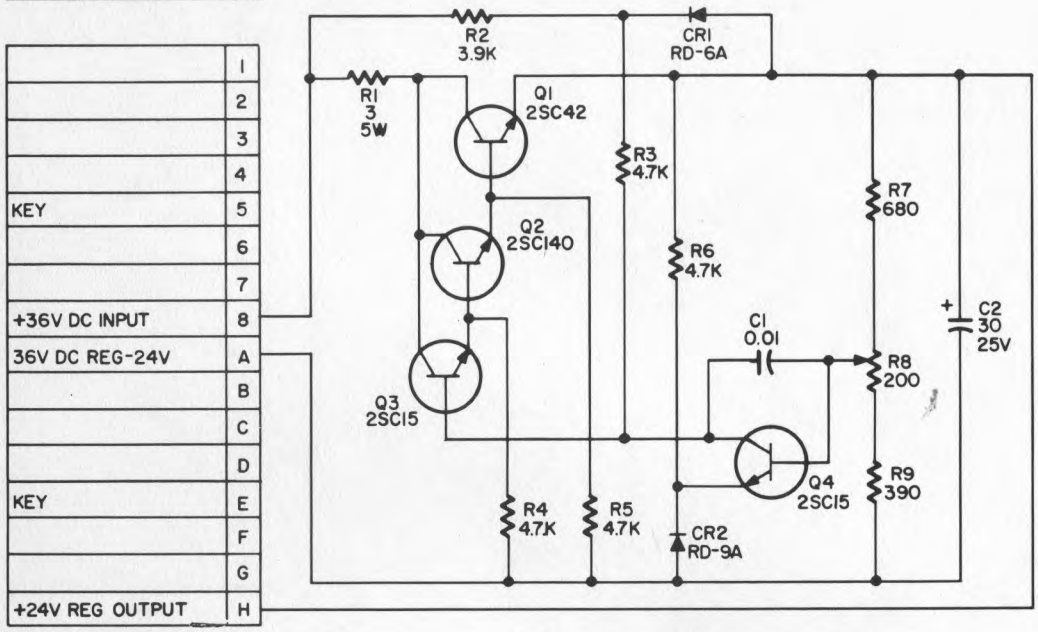
LEGEND
- POWER SUPPLY WHITE
- POWER SUPPLY BLUE
- POWER SUPPLY RED

ADD. #4

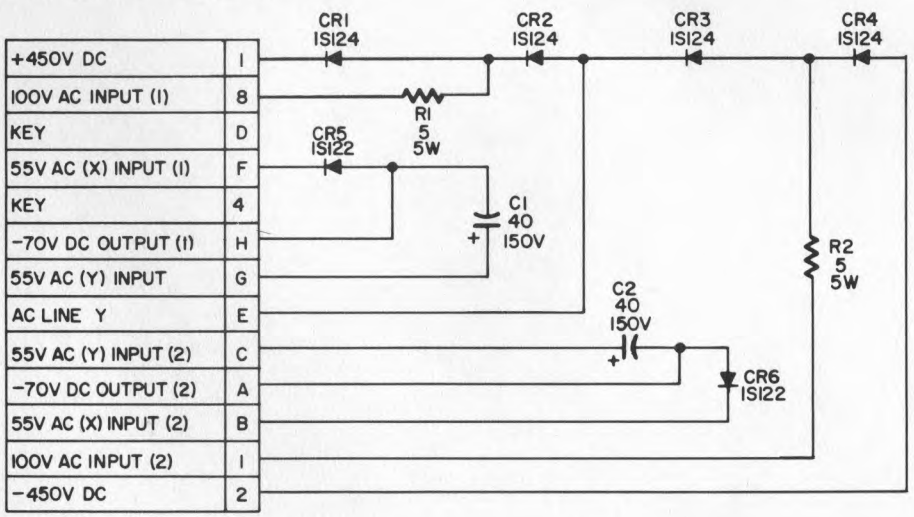
POWER SUPPLY DIAGRAM



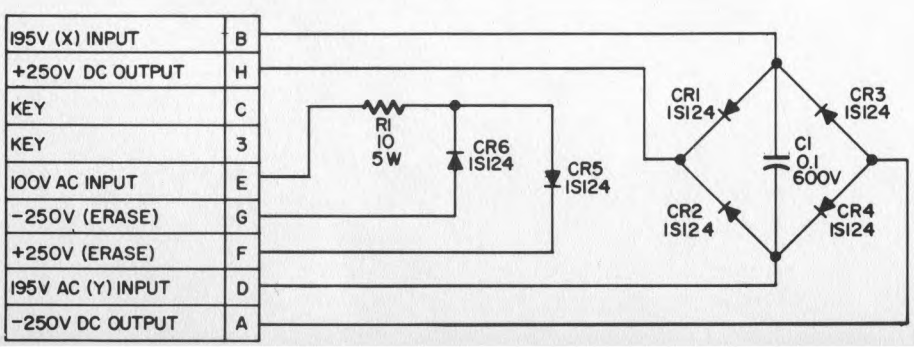
POWER SUPPLY PART 1 X-3109-90-00



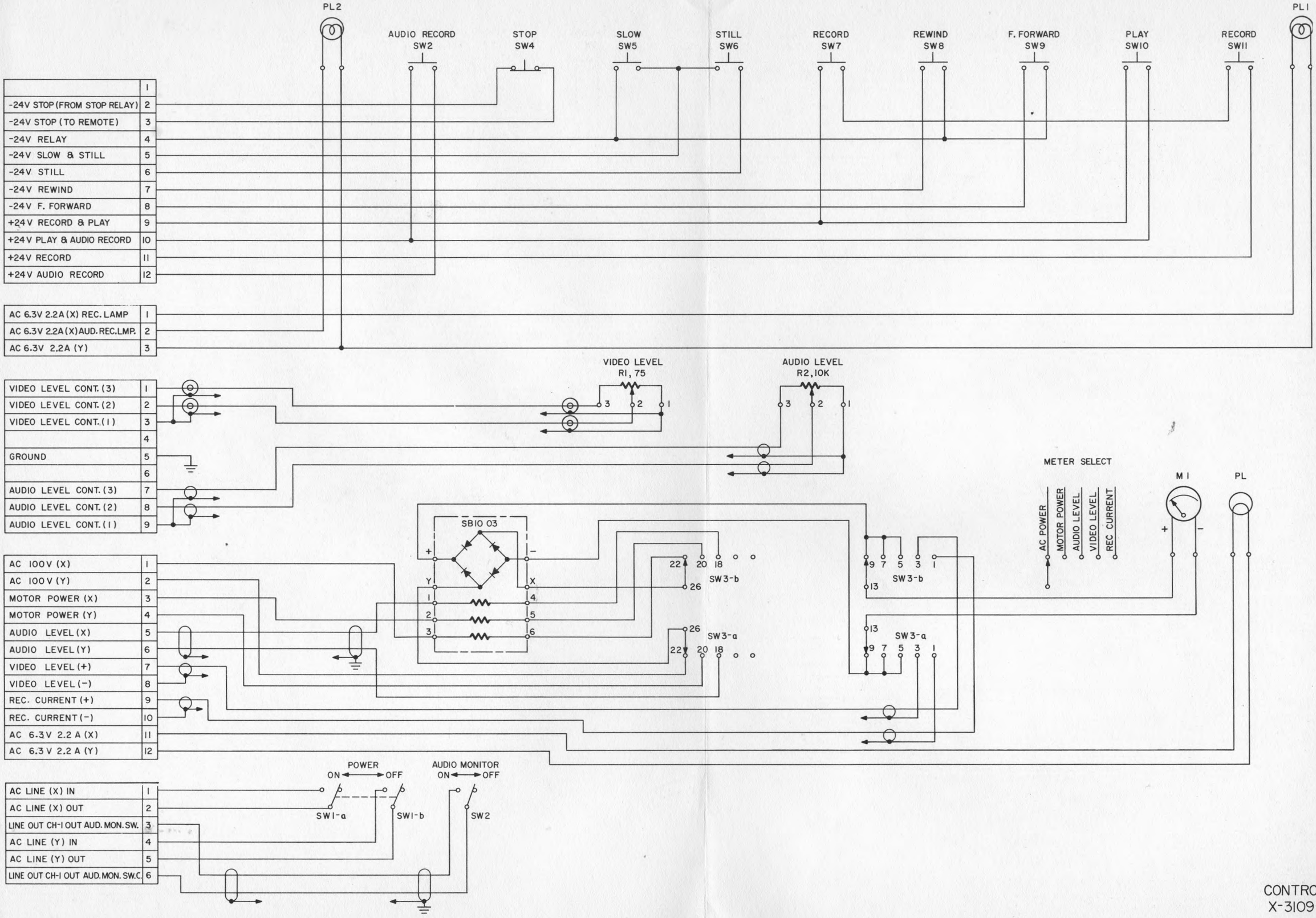
POWER SUPPLY PART 2 X-3109-91-00



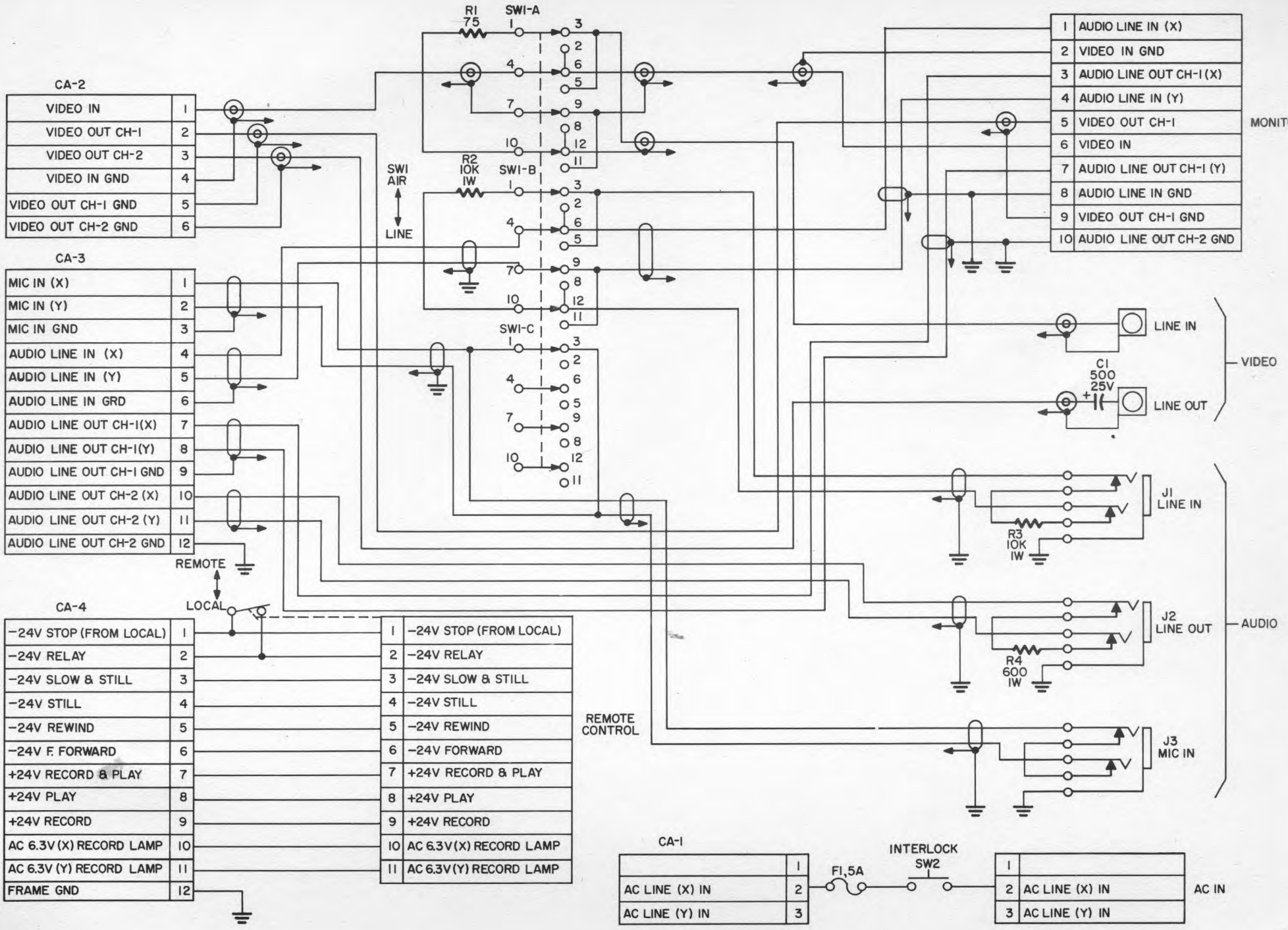
POWER SUPPLY PART 3 X-3109-92-00



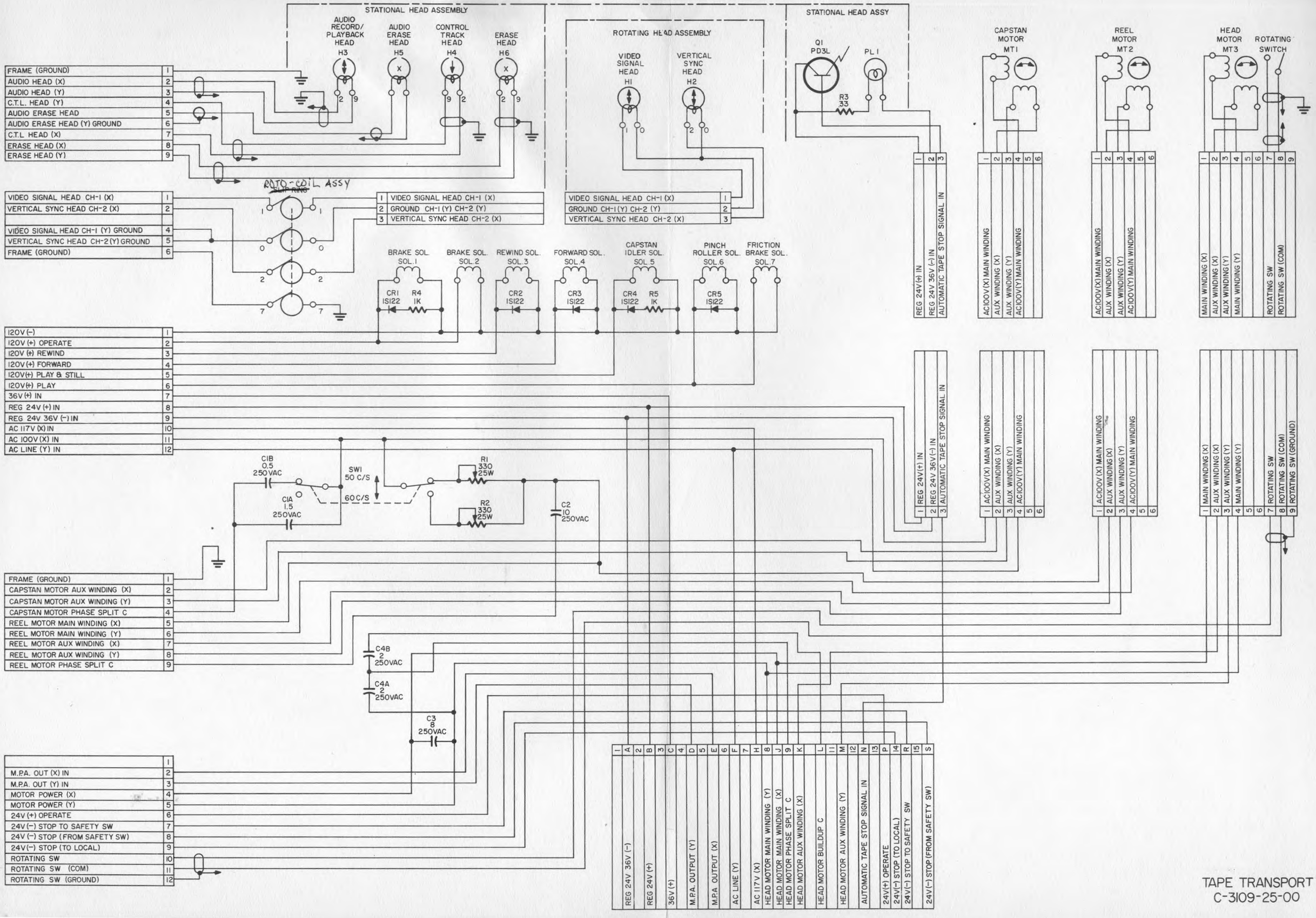
POWER SUPPLY PART 4 X-3109-93-00



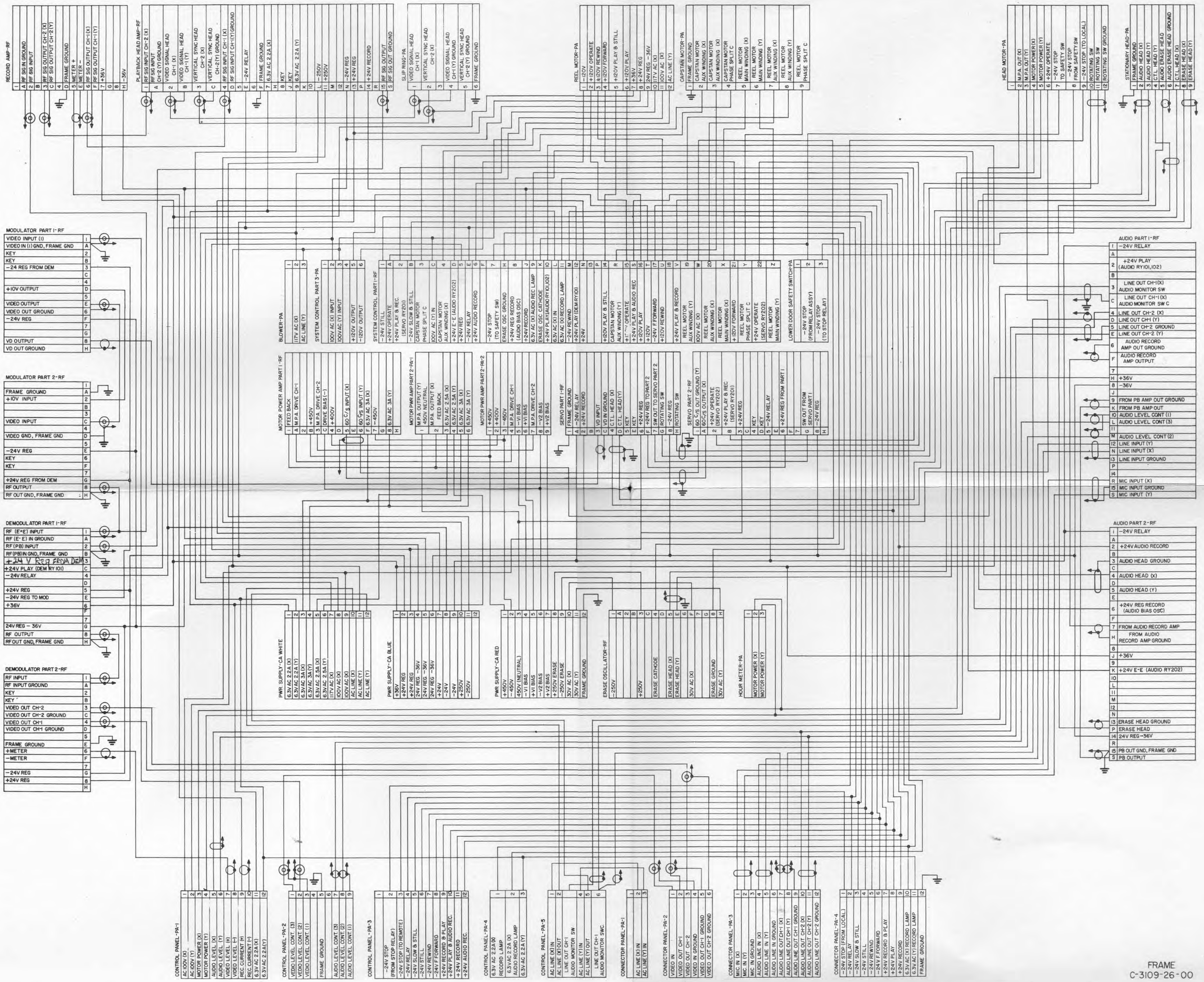
CONTROL PANEL
X-3109-94-00



CONNECTOR PANEL
X-3109-97-00



TAPE TRANSPORT
C-3109-25-00


RECORD AMP-RF
PLAYBACK HEAD AMP-RF
SLIP RING-PA
REEL MOTOR-PA
CAPSTAN MOTOR-PA
HEAD MOTOR-PA
STATIONARY HEAD-PA
MODULATOR PART 1-RF
MODULATOR PART 2-RF
DEMODULATOR PART 1-RF
DEMODULATOR PART 2-RF
BLOWER-PA
SYSTEM CONTROL PART 3-PA
SYSTEM CONTROL PART 1-RF
LOWER DOOR SAFETY SWITCH-PA
MOTOR POWER AMP PART 1-RF
MOTOR PWR AMP PART 2-PA1
MOTOR PWR AMP PART 2-PA2
SERVO PART 1-RF
SERVO PART 2-RF
AUDIO PART 1-RF
AUDIO PART 2-RF
PWR. SUPPLY-CA WHITE
PWR SUPPLY-CA BLUE
PWR SUPPLY-CA RED
ERASE OSCILLATOR-RF
HOUR METER-PA
CONTROL PANEL-PA-1
CONTROL PANEL-PA-2
CONTROL PANEL-PA-3
CONTROL PANEL-PA-4
CONTROL PANEL-PA-5
CONNECTOR PANEL-PA-1
CONNECTOR PANEL-PA-2
CONNECTOR PANEL-PA-3
CONNECTOR PANEL-PA-4
+24 V Reg FROM DEM
FRAME
C-3109-26-00